

Environmental Studies No. 66

**Patterns and trends in the
domestic fishery in and near
the Mackenzie River
watershed: A synthesis of a
survey of fish users in Dene
and Métis communities**





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Patterns and trends in the domestic fishery in and near the Mackenzie River watershed: A synthesis of a survey of fish users in Dene and Métis communities

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EXECUTIVE SUMMARY

During construction of the Norman Wells pipeline (1982-85), concern was raised by domestic fishermen about the quality of fish caught in the Mackenzie River, N.W.T. Fishermen reported catching fish with external lesions and internal abnormalities which raised questions about the safety of this traditional food supply. As one of several federally initiated studies to investigate the causes and impacts of fish abnormalities, DIAND initiated the present study to assess the state of domestic fisheries and examine the potential socio-economic impacts of the fish abnormalities.

Interviews were conducted with 202 actively fishing households from eleven communities in and near the Mackenzie River Valley. These communities were: Fort McPherson, Arctic Red River, Colville Lake, Fort Good Hope, Fort Franklin, Wrigley, Fort Simpson, Jean Marie River, Fort Resolution, Dettah and Lac La Martre. The interviews were conducted between August and December 1988, and were based on a 148-question questionnaire. The questionnaire data, based on participant recall of the fishery over the previous eight years, were examined for general patterns and trends rather than definitive quantitative descriptions of the fishery.

Fishing Households

The average size of households surveyed was 5.1 people. About 72% of the households had been keeping dogs since 1980, however, fewer dogs are now being kept. On average, 4.4 dogs were kept in 1988, representing a decline of about one-third since 1980. Fish served as an important source of dog food.

A large portion of the average household diet consisted of country foods. Country foods were estimated to account for an average of about two-thirds of the overall diet. Fish were estimated to account for, on average, about one-third of the country food diet of households. For the majority of households (84%-87%), consumption of fish had not changed over the past eight years.

The Fishery

The domestic fishery occupied an average of about 27.6 weeks per year among the communities surveyed. Fishing occupied three quarters of the year or more in some communities such as Colville Lake. Most households felt they had been fishing about the same amount since 1980, although one-quarter were fishing less than they did three years before and one-third were fishing less than they did eight years before. Residents from Fort Good Hope accounted for the greatest proportion of households that are now fishing less. The two principal factors that Dene/Metis households cited as reasons for reduced domestic fishing in communities were: 1) the trend since 1980 of keeping fewer dogs; and 2) the increasing importance of non-domestic activities in their daily lives, particularly since 1985.

The most commonly caught fish species in the spring, summer and fall fisheries were lake whitefish, broad whitefish and inconnu. During the winter, lake whitefish, broad whitefish, lake trout and burbot were the most commonly caught fish. In many communities, broad whitefish was considered to be the most important fish to households followed by lake whitefish, lake trout and long nose suckers.

The majority of households felt that fish were as abundant in 1988 as they were three (58%) and eight (52%) years previously. However, 26% - 29% of households reported that they believed there were more fish in 1988 than in these previous years.

By the end of each fishing season, the majority of households felt they had enough fish stored (smoked, dried or frozen) to meet their needs. However, over one-half of the households in some communities expressed concern about the adequacy of stored fish. This concern was most prevalent in communities along the Mackenzie River north of Norman Wells.

Fish Quality

Fish that were "abnormal" in appearance were reported by all communities except Lac La Martre. "Abnormal" fish were cited by 23%-27% of the households fishing in the spring, summer and fall. Fewer households (13%) reported seeing "abnormal" fish in the winter fishery. The greatest number of households reporting "abnormal" fish were those along the Mackenzie River as opposed to communities on lake shores. The communities of Fort Good Hope, Fort McPherson and Arctic Red River had the highest incidence of

reports of "abnormal" fish. Despite reports of "abnormal" fish, almost all (96%-100%) of the households in communities described the overall quality of the fish caught as "good" rather than "poor".

The predominance of complaints about the quality of fish was related to broad whitefish (spring, summer, fall fisheries) and burbot (all seasons). Reports of skin "abnormalities" in broad whitefish consisted largely of "scars, bites or cuts". It is suggested that some of these "abnormalities" are to be expected from natural interactions with predators, parasites or previous contact with gill nets. The broad whitefish flesh "abnormalities" consisted largely of "white spots" and "soft, watery flesh". In contrast, burbot "abnormalities" were almost exclusively internal and were reported as livers that were shrunken and discoloured ("small and dark"). Most of these complaints were from communities fishing in the Mackenzie River and its primary in-flowing rivers rather than from communities fishing in lakes.

Most households reported that if they were catching "abnormal" fish, they consisted of less than one-quarter of their catch. However there was little consensus among households about when "abnormal" fish were first noticed or how their relative numbers have changed since they were first noticed. In general, there was some perception that there were more "abnormal" fish in the summer and winter fisheries in 1988 than when they were first noticed.

The present study has demonstrated that the domestic fishery plays a prominent role in the lives of domestic fishing households. It is likely, through the local exchange of fish and related social, economic and cultural activities, that the domestic fishery also plays an important role in the community. The results of this study suggest that, overall, the state of the fishery is healthy. Fish abundance is generally perceived to be the same or better than in recent years. In most communities, the fishery provides adequate supplies of fish. The quality of the fish, for the most part, is described as being "good" and of normal appearance and taste. "Abnormalities" are not perceived to be extensive in the fishery, with the exception of specific complaints about "abnormal" burbot livers and "abnormal" broad whitefish skin and flesh quality. Perceived "abnormalities" in fish may have had little impact on the domestic fishery. However, given the prominent role, and the social and cultural value attached to the domestic fishery, the quality of the fish is of great concern to communities in the Mackenzie Valley.

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June, 1990.

Sommaire

Au cours de la construction du pipeline Norman Wells (1982-1985), les pêcheurs locaux se sont interrogés au sujet de la qualité du poisson capturé dans le fleuve Mackenzie, dans les Territoires du Nord-Ouest. Ils ont signalé les lésions externes et les malformations internes observées sur leurs prises et se sont demandés s'ils pouvaient se fier à cette source traditionnelle de nourriture. Au nombre des études effectuées par le gouvernement fédéral en vue de déterminer les causes et les répercussions de ces malformations, le MAINC a mis en branle la présente étude afin d'évaluer la situation qui entoure les pêches locales et d'examiner les répercussions possibles de ces malformations sur le plan socio-économique.

Les entrevues ont été organisées de façon à prendre en considération le point de vue de 202 ménages de pêcheurs actifs répartis dans 11 collectivités établies dans la vallée du fleuve Mackenzie et aux environs, notamment : Fort McPherson, Arctic Red River, lac Colville, Fort Good Hope, Fort Franklin, Wrigley, Fort Simpson, Jean Marie River, Fort Resolution, Dettah et lac La Martre. Ces entrevues, fondées sur une série de 148 questions, ont eu lieu entre août et décembre 1988. Les données extraites du questionnaire, faisant appel à la mémoire du participant et ayant trait à la pêche pratiquée au cours des huit années précédentes, ont été examinées en fonction de modèles et de tendances générales plutôt que sur le rapport quantitatif de la pêche.

Familles de pêcheurs

Les ménages ayant fait l'objet de l'étude en question se composaient en moyenne de 5,1 personnes. Environ 72 p. 100 des familles possédaient des chiens depuis 1980; cependant, le nombre de chiens diminue de plus en plus. En 1988, on comptait en moyenne 4,4 chiens par famille, ce qui représente une baisse d'environ un tiers depuis 1980. Le poisson était un élément important de l'alimentation des chiens.

Le régime alimentaire d'un ménage moyen se composait en grande partie de produits régionaux. Selon les estimations, les produits régionaux représentaient en moyenne environ les deux tiers du régime global tandis que le poisson correspondait en moyenne à près du tiers de l'alimentation des ménages en produits régionaux. Dans la plupart des ménages (84 à 87 p. 100), la consommation du poisson n'avait pas changé au cours des huit dernières années.

La pêche

La pêche de subsistance représentait en moyenne environ 27,6 semaines par année chez les collectivités à l'étude. Dans les collectivités comme celles du lac Colville, la pêche était pratiquée pendant les trois quarts de l'année ou plus. La plupart des ménages estimaient avoir consacré à la pêche à peu près le même temps depuis 1980, bien qu'un quart d'entre eux aient pêché moins que les trois années précédentes et qu'un tiers aient pêché moins qu'il y a huit ans. Les résidents de Fort Good Hope se situent dans la plus grande partie des ménages qui pêchent moins maintenant. Selon les familles de Dénés et de Métis, les deux principales raisons auxquelles la baisse de la pêche de subsistance dans les collectivités peut être attribuée sont les suivantes : 1) la tendance enregistrée depuis 1980 à garder de moins en moins de chiens et 2) l'importance accrue des activités non domestiques dans leur vie quotidienne, particulièrement depuis 1985.

Les espèces les plus couramment pêchées au printemps, à l'été et à l'automne comprennent le corégone de lac, le corégone tschir et le saumon du Mackenzie. Durant l'hiver, le corégone de lac, le corégone tschir, la truite fardée et la lotte constituent les genres de poissons les plus couramment pêchés. Dans bon nombre de collectivités, le corégone tschir est considéré comme le poisson le plus important aux yeux des familles; viennent ensuite le corégone de lac, la truite fardée et le meunier rouge.

La plupart des ménages estiment que le poisson était aussi abondant en 1988 que trois (58 p. 100) et huit (52 p. 100) ans auparavant. Toutefois, 26 à 29 p. 100 des ménages estiment que les quantités de poisson étaient beaucoup plus grandes en 1988 qu'elles ne l'étaient au cours des années antérieures.

À la fin de chaque saison de pêche, la plupart des ménages estimaient qu'ils avaient suffisamment de poisson en réserve (fumé, séché ou congelé) pour satisfaire à leurs besoins. Cependant, dans certaines collectivités, plus de la moitié des familles ont fait part de leurs préoccupations au sujet du bien-fondé des réserves de poisson. Cette préoccupation était plus répandue dans les collectivités situées le long du fleuve Mackenzie, au nord de Norman Wells.

Qualité du poisson

Les poissons présentant des "malformations" ont été signalés par toutes les collectivités, sauf celle du lac La Martre. Ces cas ont été cités par 23 à 27 p. 100 des familles pratiquant la pêche au printemps, à l'été et à l'automne. Peu de ménages

(13 p. 100) ont découvert des poissons atteints de "malformations" dans les prises d'hiver. Le plus grand nombre de familles ayant déclaré des cas de "malformations" habitaient le long du fleuve Mackenzie par opposition aux collectivités établies en bordure des lacs. Les collectivités de Fort Good Hope, Fort McPherson et Arctic Red River comptaient parmi celles qui détenaient le taux le plus élevé de déclarations concernant les poissons atteints de "malformations". Malgré les déclarations de ce genre, presque toutes (96 à 100 p. 100) les familles dans l'ensemble des collectivités ont décrit la qualité globale du poisson capturé comme étant "bonne" plutôt que "médiocre".

Les principales plaintes concernant la qualité du poisson portaient sur le corégone tchir (printemps, été et automne) et la lotte (en toute saison). Les "malformations" de la peau chez le corégone tchir prenaient en grande partie la forme de "cicatrices, morsures ou coupures". Il faut s'attendre, semble-t-il, à voir des "malformations" de ce genre probablement attribuables aux interactions naturelles avec les prédateurs, les parasites ou un contact antérieur avec les filets à mailles. Les "malformations" de la chair du corégone tchir consistaient en grande partie en "taches blanches" et "dans l'aspect mou et aqueux des chairs". Par contre, les "malformations" de la lotte étaient presque exclusivement internes, notamment un foie ratatiné et terni ("petit et foncé"). La plupart de ces plaintes provenaient de collectivités pratiquant la pêche dans le fleuve Mackenzie et dans ses principaux affluents plutôt que des collectivités pêchant dans les lacs.

La plupart des ménages ont déclaré que les poissons atteints de "malformations" représentaient moins du quart de leurs prises. Cependant, il a été impossible d'en arriver à un consensus sur la première fois que ce phénomène a été observé, ou encore, sur le nombre relatif de modifications observées depuis la première manifestation du phénomène. En général, on s'accorde pour dire qu'il y avait un plus grand nombre de "malformations" au cours de l'été et de l'hiver de 1988 qu'au tout début de leur apparition.

La présente étude a démontré que la pêche de subsistance jouait un rôle important dans la vie des familles de pêcheurs locaux. Il est fort probable que, par l'intermédiaire des échanges de poissons et des activités connexes du domaine social, économique et culturel, la pêche de subsistance tienne aussi une place importante dans la collectivité. Selon les résultats de la présente étude, la situation globale des pêches est excellente. La quantité de poissons est en général considérée comme étant de la même taille ou meilleure que celle enregistrée au cours des dernières années. Dans la plupart des collectivités, la pêche permet de faire des provisions suffisantes de poissons. La qualité du poisson est en grande partie décrite comme étant "bonne"; l'apparence et

le goût ne semblent pas avoir été modifiés. "Les malformations" ne sont pas considérées comme étant très répandues dans les pêcheries, sauf dans le cas des plaintes particulières portant sur le foie difforme de la lotte et la qualité anormale de la peau et de la chair du corégone tchir. Il est fort possible que les "malformations" observées aient eu bien peu de répercussions sur la pêche de subsistance. Cependant, étant donné le rôle important et la valeur sociale et culturelle accordés à la pêche, la qualité du poisson est une préoccupation majeure aux yeux des collectivités de la vallée du Mackenzie.

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The Rawson Academy's analysis of the Lutra data was conducted by Mr. Todd Sellers under the general supervision of Dr. Peter Sly, Director of the Academy's Science Program. Mr. Sellers is the author of this report.

Abstract

Between the summer and early winter of 1988, 202 Dene and Metis households, participating in the domestic fishery of the Mackenzie Valley were surveyed. Country foods were estimated to account for about two thirds of household diet. Fish were estimated to account for about one third of the country food component of household diet. For most households, fish consumption had not changed since 1980. Fishing activity has decreased somewhat since 1980 for some households, particularly households from Fort Good Hope. Trends toward keeping fewer dogs, and increasing importance of non-domestic fishing activities are suggested as contributing to reduced domestic fishing. Net fishing is the principle method used in the domestic fishery. However, households in some communities angle for fish, notably many of the households in Fort Franklin. Broad whitefish dominated the river fishery of the north Mackenzie River region, and was considered to be the most important species. Broad whitefish was also the most important species in the river fishery of the south Mackenzie River region. Lake trout was the most important species in the lake fisheries of the north Mackenzie River region. Lake whitefish dominated the fishery and was considered to be the most important species in lake fisheries in the south Mackenzie River region. The domestic fishery in the Mackenzie River valley operates during most months of the year. Households devoted an average of 27.6 weeks during the year to domestic fishing. Overall, the abundance of fish is perceived to have remained about the same since 1980. Households are generally satisfied with the ability of the domestic fishery to provide adequate supplies of fish, except for some communities in the north Mackenzie River fishery. Fish are generally perceived to be of good quality. However, many households were concerned about the quality of burbot and broad whitefish. Approximately one third of all households that caught burbot believed that there was something wrong with the livers of some of the fish. These complaints of "abnormalities" in burbot consisted largely of "small dark" livers and, for the most part, came from households fishing rivers in the north Mackenzie River area. Approximately one third of all households that caught broad whitefish believed that there was something wrong with some of these fish. These complaints about broad whitefish were largely of external "scars, bites and cuts" and flesh quality ("white spots" and "soft and watery flesh"). For the domestic fishery of the Mackenzie River valley overall, the perception of "abnormalities" in fish appears to have had little impact on the fishery. However, the domestic river fishery of the north Mackenzie River region, particularly for households in Fort Good Hope, may have been affected.

Résumé

Entre l'été et le début de l'hiver de 1988, 202 familles de Dénés et de Métis pratiquant la pêche dans la vallée du Mackenzie ont participé à une étude. Selon les estimations, les produits régionaux représentaient environ les deux tiers du régime alimentaire des ménages alors que le poisson correspondait à près du tiers de l'élément considéré comme produits régionaux. Dans la plupart des familles, la consommation du poisson n'a pas changé depuis 1980. La pêche en tant qu'activité a diminué toutefois depuis 1980 dans certaines familles, notamment celles de Fort Good Hope. La tendance à garder moins de chiens et l'importance accrue des activités non domestiques ont contribué à réduire le recours à la pêche de subsistance. La pêche au filet est la principale méthode utilisée dans ce domaine. Cependant, dans certaines collectivités, les ménages pêchent à la ligne, notamment de nombreuses familles de Fort Franklin. Le corégone tschir, occupant une position dominante dans la pêche fluviale pratiquée dans la région septentrionale du fleuve Mackenzie, était considéré comme l'espèce la plus importante. Il était aussi considéré comme l'espèce la plus importante de la pêche fluviale dans la région méridionale du fleuve Mackenzie. La truite fardée occupait le premier rang dans le cas de la pêche pratiquée dans les lacs de la région septentrionale du Mackenzie tandis qu'au sud cette place revenait d'abord au corégone de lac. Dans la vallée du fleuve Mackenzie, la pêche se pratique quasiment à longueur d'année. Au cours de l'année, les ménages ont consacré en moyenne 27,6 semaines à la pêche de subsistance. Dans l'ensemble, l'abondance du poisson est demeurée sensiblement la même depuis 1980. En général, les ménages considèrent la pêche comme un moyen satisfaisant de faire des provisions suffisantes de poissons, sauf dans certaines collectivités situées au nord du fleuve Mackenzie. Le poisson est en général considéré comme étant de bonne qualité. Toutefois, bon nombre de ménages se préoccupent au sujet de la qualité de la lotte et du corégone tschir. Environ le tiers des ménages qui capturent de la lotte estimaient que le foie de certains poissons comportait certaines "malformations", à savoir des foies "petits et foncés". Dans la plupart des cas, ces plaintes émanaient de ménages pratiquant la pêche fluviale dans la partie nord du Mackenzie. À peu près le tiers des ménages qui capturaient du corégone tschir estimaient que certains de ces poissons étaient atteints de "malformations", notamment lésions externes comme "cicatrices, morsures et coupures" et qualité médiocre de la chair ("taches blanches" et "chairs molles et aqueuses"). Dans l'ensemble de la vallée du Mackenzie, il semblerait que ces "malformations" auraient eu très peu de répercussions sur les pêcheries. Toutefois, il est possible que les pêcheurs fluviaux de la région septentrionale du Mackenzie, particulièrement les ménages de Fort Good Hope, en aient été affectés.



1. INTRODUCTION

Concurrent with the construction of the Norman Wells pipeline (1982-1985), concern was raised by domestic fishermen about the quality of fish caught in the Mackenzie River. Residents of Fort Good Hope in particular, reported that they were catching fish that were "abnormal" in appearance. These "abnormal" fish were described as having external and internal abnormalities, consisting largely of external lesions and "watery" muscle tissue in broad whitefish, Coregonus nasus, and lake whitefish, Coregonus clupeaformis; and shrunken, dark coloured livers, notably in burbot, Lota lota. Because of the dietary importance of fish to the Dene and Métis of the region, and the cultural and economic importance of domestic fishing, reports of "abnormalities" caused concern for the safety of the traditional food supply and for sustaining the domestic fishery.

Concern about the quality of the fish resource and potential effects on the health, culture and economy of Mackenzie Valley fish users remained after the Norman Wells oilfield and pipeline project was completed and monitoring funds terminated. In 1985, the Department of Indian Affairs and Northern Development (DIAND) and the Department of Fisheries and Oceans (DFO), in conjunction with the Dene Nation, sponsored a study to investigate the potential relationship between the condition of fish in the Mackenzie River and oil pollution from the Norman Wells development. The report of this study has recently been published as Environmental Studies No. 61 "Studies to Determine Whether the Condition of Fish from the Lower Mackenzie River is Related to Hydrocarbon Exposure" (Lockhart et al. 1989). In 1987, Health and Welfare Canada initiated a dietary study of the residents of Colville Lake and Fort Good Hope in order to assess the exposure of the Dene and Métis to toxaphene, an organochlorine contaminant identified in burbot livers from the Mackenzie River. This study is near completion and will provide information on dietary habits and nutrient and contaminant levels in the diets.

The existence of low levels of low-boiling aromatic hydrocarbon contamination of fish in areas of the Mackenzie River has been confirmed (Lockhart 1987, 1989; Morgan et al. 1987). Lockhart (1989) identified four low-boiling aromatic hydrocarbons in liver tissue of burbot and in muscle tissue of whitefish, namely ethylbenzene, m-xylene, p-xylene and o-xylene. Polycyclic aromatic hydrocarbon (PAH) contamination of both liver and muscle tissue of burbot was also found by Lockhart (1989), notably naphthalene,

phenanthrene, chrysene/benz(a) anthracene, and fluorene and fluoranthene. Benz(a)pyrene was also identified, but in relatively few of the fish analysed. The sources of hydrocarbon contamination were suggested by Lockhart (1989) to be:

- general background levels in the river, possibly contributed to by long range aerial distribution of hydrocarbons; and
- point sources of hydrocarbon loading to the river, presumably natural seepage or effluents at Norman Wells.

Organochlorine contamination of fish from arctic communities has also been reported, notably toxaphene, PCBs and chlordane. Lockhart (1987, 1989) reported unexpectedly high levels of toxaphene contamination of some burbot liver and noted that consumption of less than 1 gram of liver from these fish would be equivalent to the average US daily intake of toxaphene. The sources of the organochlorine contamination found in these fish was suggested by Lockhart (1989) to be:

- general aerial distribution of organochlorine compounds from southern latitudes; and
- possible additional, but unknown sources, within the Mackenzie River watershed.

While some research into levels of contamination in fish, and human dietary exposure had been conducted, the potential socio-economic effects of this contamination on the domestic fishery and the fish users themselves had yet to be documented.

The study summarized in this document was initiated to assess three issues:

- the state of the domestic fishery;
- the perceived extent of "abnormalities" in fish; and
- the potential impact of the "abnormalities" on the domestic fishery.

The survey data was gathered during the summer, fall and early winter of 1988. Lutra Associates provided a preliminary two volume report in July 1989. In the fall of 1989, the Rawson Academy of Aquatic Science was asked to review the data and to prepare the present report.

2. METHODS

2.1 Survey Development and Design

In April 1988, Lutra Associates Ltd., in association with P.J. Usher Consulting Services and LGL Environmental Research Associates were commissioned by the Department of Indian Affairs and Northern Development to conduct a survey of the state of domestic fisheries in eleven Dene and Métis communities in and near the Mackenzie River watershed.

A draft questionnaire was developed by Lutra Associates Ltd. with input from DIAND, the Dene Nation, P.J. Usher Consulting Services, LGL Environmental Research Associates, the Fort Good Hope Dene Community Council, a former member of the Fort Good Hope Resource Development Impact Program, Health and Welfare Canada and the Department of Renewable Resources of the Government of the Northwest Territories. This draft questionnaire was tested in Dettah and Rainbow Valley, two small Dogrib communities located near Yellowknife. These communities were selected for testing because they were easily accessible and were thought to be representative of the economy and lifestyle in small Dene and Métis communities. A bilingual (Dogrib and English) local researcher delivered the survey under the supervision of Lutra's survey coordinator.

Several issues arose in testing of the questionnaire. Despite endorsement of the survey by community leaders and the hiring of a local researcher, the response of the test residents in Dettah and Rainbow Valley indicated that many were:

- distrustful of the survey objectives;
- reluctant to provide information related to fish harvest and fish use;
- unwilling to participate; and
- unwilling to complete the entire questionnaire.

In all, 7 of the 13 test questionnaires were completed.

The questionnaire was modified to incorporate results of the testing and was reviewed by P.J. Usher Consulting Services and LGL Environmental Research Associates. As a result of this final review, the wording of several questions was refined, additional

questions were added, including "cross check" questions, and the overall length of the questionnaire reduced. Due to time and financial constraints, testing of the questionnaire in its final form was not conducted.

The questionnaire in its final form was relatively lengthy, complex and repetitive, requiring responses to at least 148 questions (assuming that the household fished in each season, and caught only one species in each season). The final questionnaire was organized into four thematic sections:

- introductory questions, designed to stimulate thought about the domestic fishery, determine whether the household participated in the fishery and collect general household demographic information;
- season-specific information about the domestic fishery in the latest year fished, designed to develop a profile of the seasonal fisheries including duration, effort, fishing method, species caught, perceived quality of the fish, and use of fish;
- historical questions comparing the current domestic fishery to the fishery three and eight years before, to identify changes in the state of the fishery;
- general questions to determine the role of fish and other country food in the household diet, and to provide an opportunity for the households to offer additional information about the fish that they caught and about the fishery in general.

2.2 Survey Procedure

2.2.1 Sampling Method

Eleven communities were selected by the Dene Nation and DIAND for inclusion in this survey. These communities were:

- Fort McPherson;
- Arctic Red River;
- Colville Lake;
- Fort Good Hope;
- Fort Franklin;
- Wrigley;
- Fort Simpson;
- Jean Marie River;
- Fort Resolution;
- Dettah; and
- Lac La Martre.

The location of these communities is shown in Figure 1. These communities were selected to represent the variety of communities in and near the Mackenzie River watershed and to provide a profile of the following characteristics:

- small, traditional Dene and Métis communities;
- large, quasi-urban Dene and Métis communities;
- communities located on the Mackenzie River and its primary in-flowing rivers;
- communities located on inland lakes;
- communities from which reports of "abnormal" fish had been received; and
- communities from which no reports of "abnormal" fish had been received.

Discussions were held with representatives from the Band Council and the Métis Local, local researchers, the local Wildlife Officer (GNWT) and or the local land selection staff (Dene/Métis Negotiating Secretariat). On the basis of these discussions, several aspects of community profile were developed, including:

- a list of all identified Dene and Métis households that fish;
- the community definition of what constituted "active, serious domestic fishing households"; and
- a list of Dene and Métis households in each community that were considered to be "active, serious domestic fishing households".

The number of Dene and Métis households in each community except Fort Simpson was estimated from water delivery records. In Fort Simpson, the Dene Band list was used to enumerate household units.

To ensure that households that were actively involved in the domestic fishery participated in this study, a stratified selection regime was devised. Two strata were constructed, comprised of households defined by community representatives as "active, serious domestic fishing" and households that fished but were not defined as "active, serious domestic fishing". Sample selection included both strata in all communities except Fort Simpson. In this community, the sample consisted of households that fished but were not involved in "active, serious domestic fishing". Of the stratified sample population of households in each community, one third were selected to participate in the survey.

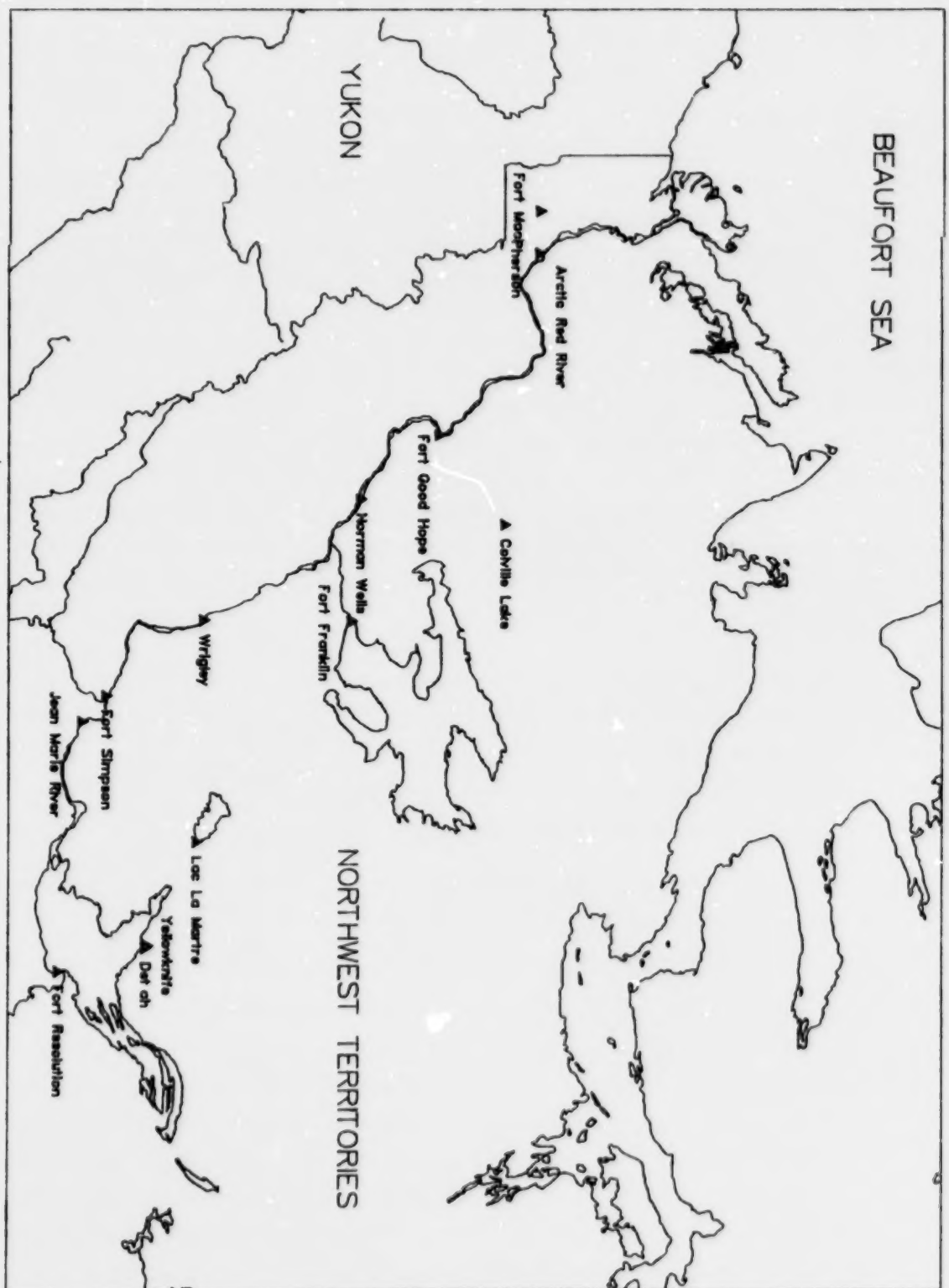


Figure 1: The Mackenzie River Valley study area indicating Dene and Métis communities participating in survey.

2.2.2 Selection of Researchers and Training

The questionnaire was delivered exclusively by bilingual Dene and Métis researchers hired by Lutra Associates Ltd. in each community. Researchers were selected on the basis of personal interviews conducted by Lutra Associates' survey coordinator, previous research experience, linguistic and communication skills, availability, and recommendation from Band Councils, Hamlet Councils, Métis Locals and or Hunters and Trappers Associations (HTAs). Based on projected workload, more than one researcher was hired in several communities. Three researchers were hired in Fort McPherson and Fort Good Hope (Fort Good Hope researchers conducted the survey in Colville Lake as well), two in Fort Franklin, Wrigley and Fort Simpson, and one in Arctic Red River, Jean Marie River, Fort Resolution, Dettah and Lac La Martre.

Researchers were provided with background information about the survey as well as a briefing on the purpose of each question to ensure familiarity with the questionnaire. Lutra Associates' survey coordinator audited a minimum of three household interviews per researcher to ensure understanding and proper delivery of the questionnaire.

2.2.3 Survey Delivery

Table 1 shows the number of households selected for this survey. Two hundred and sixty-seven households were selected to participate in the survey. Of these, just over one third were classified as "active, serious fishing" and the remainder were households that participated in the domestic fishery but to a lesser degree. As shown in Table 1, 78 "active, serious fishing" households and 124 households classified as not being "active, serious fishing" participated in the study, providing an overall response rate of 76%. Follow up investigations were conducted by Lutra Associates Ltd. for households which had no response or incomplete responses. Nevertheless, few households responded to all of the questions. Response rate for individual questions varied, and in some cases was as low as 0%. Thus the effective response rate to the survey, as a whole, was generally lower than indicated above.

Table 1: Number of households participating in survey

Community	Total N° of Dene and Métis Households	"Active, Serious fishing" households		Other fishing households	
		N° Selected	N° Surveyed	N° Selected	N° Surveyed
Arctic Red River	29	4	4	6	6
Colville Lake	11	4	4	0	0
Dettah	20	7	3	4	0
Fort Franklin	99	7	7	27	27
Fort Good Hope	115	11	8	27	23
Fort Resolution	110	10	8	27	23
Jean Marie River	11	4	4	0	0
Lac La Martre	58	15	15	4	4
Fort McPherson	143	28	23	20	19
Fort Simpson	150	0	0	50	15
Wrigley	36	3	2	9	7
Total	782	93	78	174	124

Before starting the survey, Lutra Associates Ltd. discussed the background and objectives of the survey with community representatives in order to obtain their support for the study. In most communities there was a high degree of support for and interest in the study.

The Dene and Métis communities selected for this study were interviewed between August and the third week of December, 1988. An attempt was made to interview each household as a "harvesting unit". However, in many cases it proved difficult to assemble all household members and interviews were then conducted with the head of the household, usually the oldest male. Prior to each interview the background and objectives of the survey were discussed with the household. The survey was conducted orally and

responses recorded by the researcher. Delivery of the survey took approximately one and a half hours per household.

Data from the questionnaires were compiled by Lutra Associates Ltd. on a community by community basis, using dBase III+ software. Non-numeric data were coded prior to entry into the database to facilitate entry and analysis.

2.2.4 Data Analysis and Reporting

In July 1989, Lutra Associates Ltd. presented DIAND with a two volume report "Survey of Fish Users In Dene and Métis Communities in and Near the Mackenzie River Watershed" documenting the findings of their study. DIAND subsequently contracted the Rawson Academy of Aquatic Science to summarize the Lutra report. The Lutra and Associates' report was reviewed and the associated database re-analysed. Analysis of the questionnaire data was conducted based on the number of respondents to each question, unless otherwise noted. Where warranted, the data were grouped for analysis into households fishing in:

- rivers in the north Mackenzie River area;
- rivers in the south Mackenzie River area;
- lakes in the north Mackenzie River area; and
- lakes in the south Mackenzie River area.

The Norman Wells oilfield area was chosen as the division between north and south Mackenzie communities. The community assignment to these groups is shown in Table 2.

Table 2: Regional Fishery Groupings of Communities

	River	Lake
North Mackenzie	Arctic Red River Fort McPherson Fort Good Hope	Colville Lake Fort Franklin
South Mackenzie	Wrigley Fort Simpson Jean Marie River	Fort Resolution Lac La Martre Dettah

The questionnaire data, particularly the data based on participant recall of the fishery over the previous eight years, were of low resolution and low precision. Thus, the results of this questionnaire have been interpreted as much as possible to suggest general trends and patterns in the domestic fishery, rather than a detailed description.

3. RESULTS

3.1 Household Profile

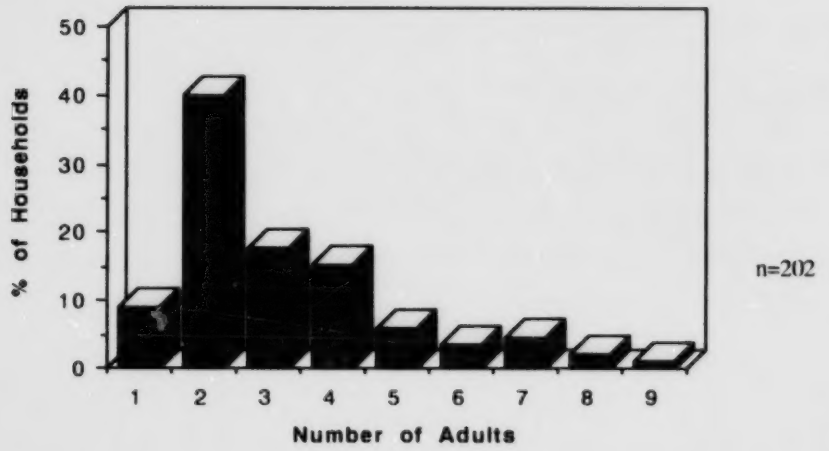
The households in this study are considered to be representative of those participating in the domestic fishery in and near the Mackenzie River Basin. Only those people participating in the domestic fishery were targetted in the stratified selection procedure and therefore the survey is not necessarily representative of their communities as a whole.

The average size of households surveyed was 5.1 people, comprised of 3.1 over the age of sixteen years ("adults") and 2.0 people age sixteen years or younger ("children"). However, the average number of "adults" was not necessarily representative of the typical household. Figure 2, showing the household profile for both "adults" and "children", suggests that most commonly, the typical household had four members, consisting of two people older than sixteen years and two people younger than sixteen years. While the typical household had four members, there were several relatively large households in this study, that had between five and nine adult members.

Most of the households in this study kept dogs. In 1988, dogs were kept by about 72% of the households; a proportion that has remained essentially constant over the previous eight years. However, the number of dogs kept by households has declined in recent years. On average, 4.4 dogs were kept in 1988, representing a reduction of about one third since 1980 (Figure 3). While the average household had 4.4 dogs, a few households kept many more (Figure 4). In these households, dogs are probably raised and kept for professional sled dog racing.

Fish has been used as dog food by essentially all of the households that keep dogs. Fish, for the most part, were fed whole to the dogs, without cleaning. In addition, fish scraps were used as dog food.

Household Survey Profile: Adults (>16 years)



Household Survey Profile: Children (≤ 16 years)

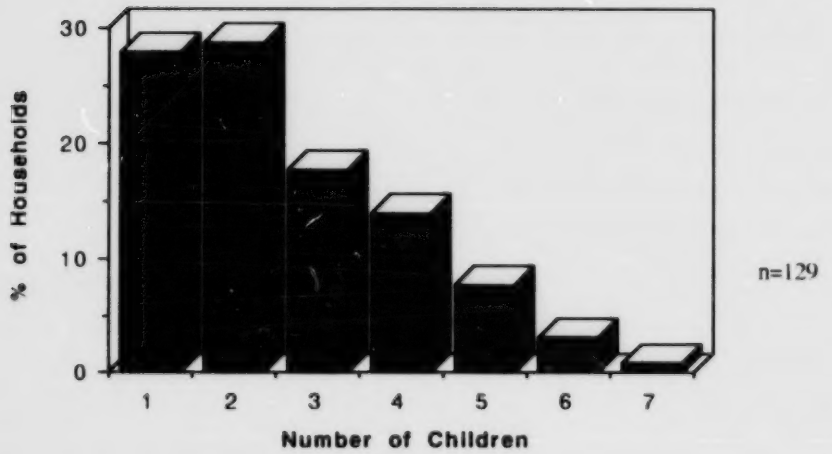


Figure 2: Demographic profile of households.

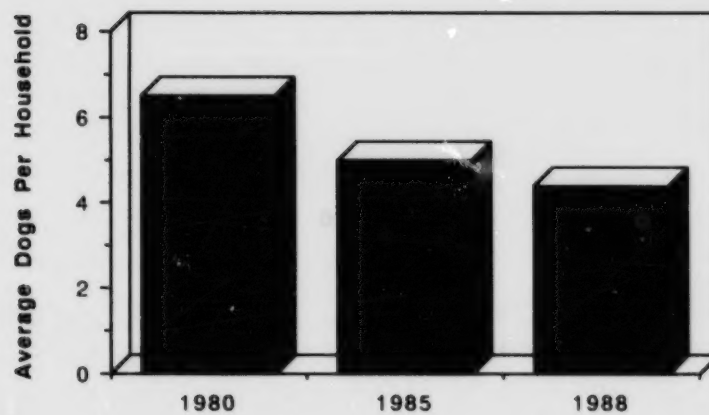


Figure 3: Change in the average number of dogs kept.

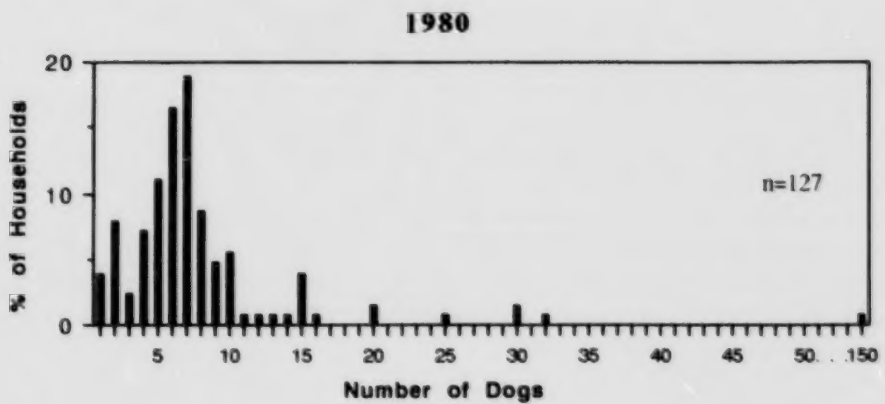
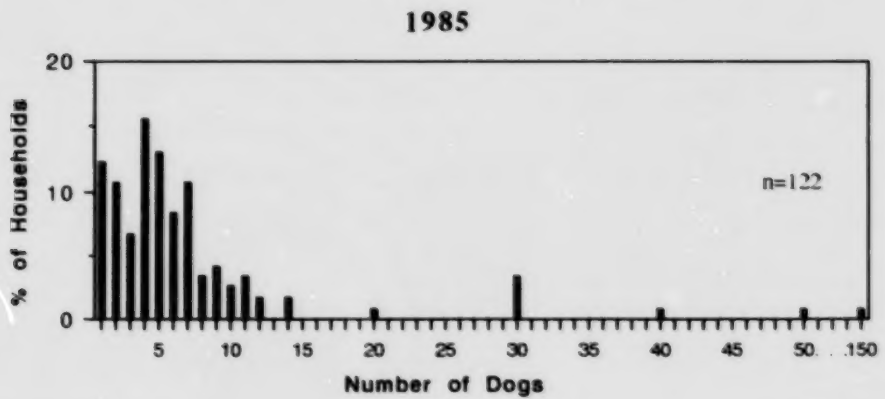
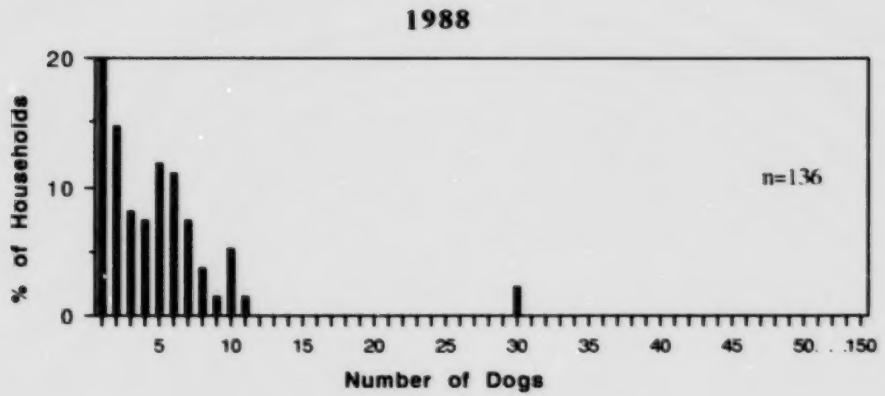


Figure 4: Historical profiles of dog possession.

3.2 Human Diet

The diets of the households surveyed consisted largely of country food. Figure 5, showing the proportion of country food in the diet, suggests that country food most commonly comprises between one half and three quarters of the household diet. On the basis of these data, country food is estimated to account for about two thirds of the overall household diet.

Fish accounts for a substantial portion of the country food in the diet of these households. Figure 6, showing the fish component of the country food diet, suggest that fish most commonly accounts for between one quarter and one half of the country food consumed. On the basis of these data, a likely estimate would be that fish accounts for about one third of the country food in the diet of these households.

For the majority of households (84%-87%), consumption of fish has not changed over the past three years nor over the past eight years (Figure 7). However, a relatively small number of households are apparently eating less fish than they used to. Of the four households who reported reasons for decreased fish consumption over the past three years, all attribute this to decreased domestic fishing activity, such as "not fishing as much" or "spending less time on land". Of the seven households who reported reasons for their decreased fish consumption over the past eight years, five attributed this to decreased domestic fishing activity (see above), one cited "getting old" and one household expressed concern that the "fish are not good to eat".

Of households that are eating less fish than they used to, response was relatively poor to questions about what kind of food had replaced the fish in their diet. Thus interpretation of the response to this question should be viewed as suggestion, rather than conclusion. On this basis, Figure 8, showing the alternative foods that replaced fish suggests:

- since 1980, other country foods have become more important;
- since 1985, store bought foods have become increasingly important in the diet.

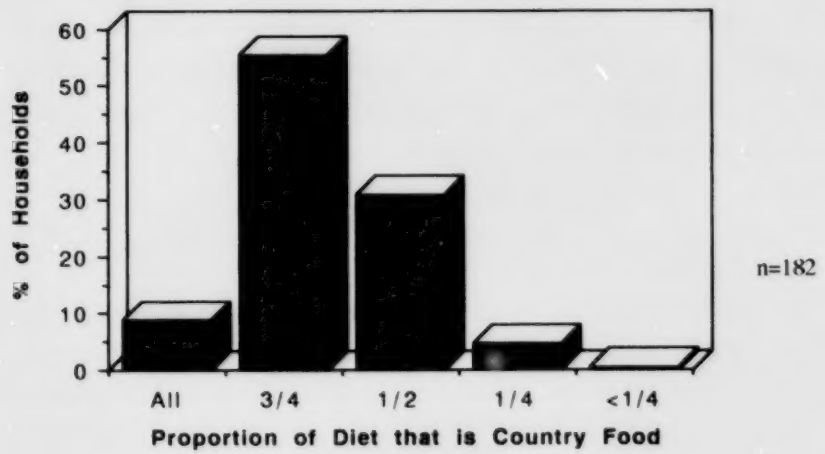


Figure 5: Proportion of country food in human diet.

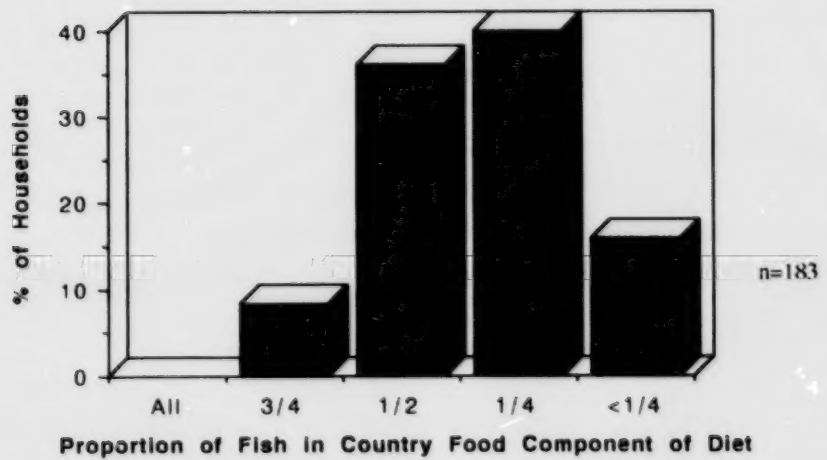
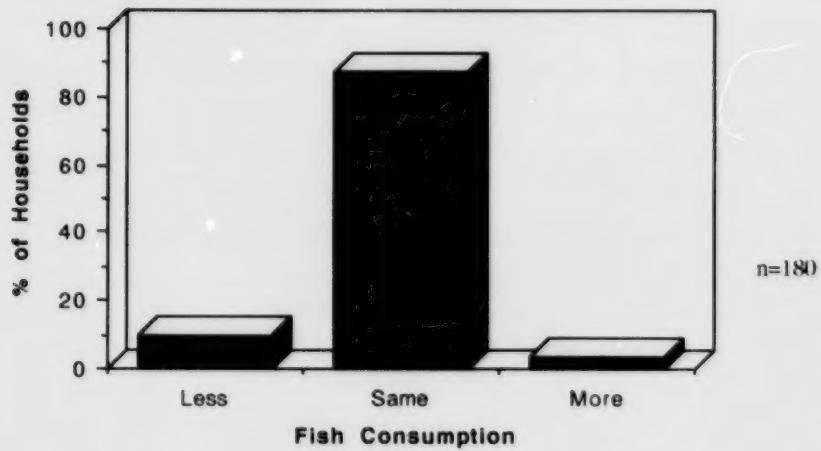


Figure 6: Fish component of country food in human diet.

Fish Consumption in 1988, Compared to 1985



Fish Consumption in 1988, Compared to 1980

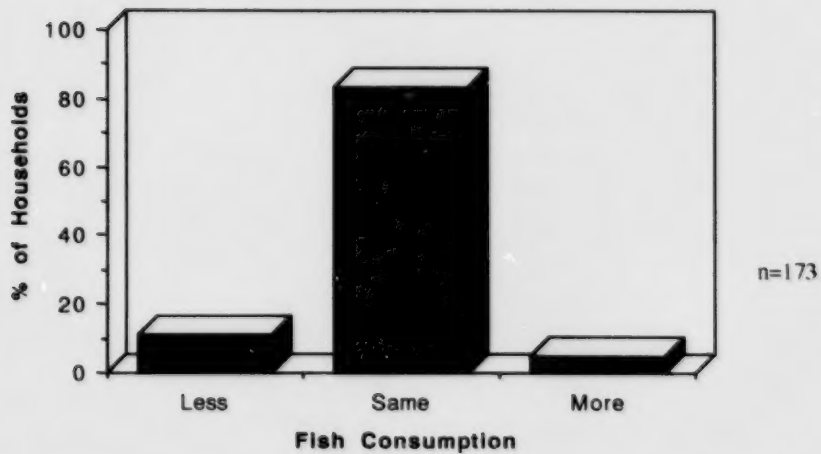


Figure 7: Change in fish consumption.

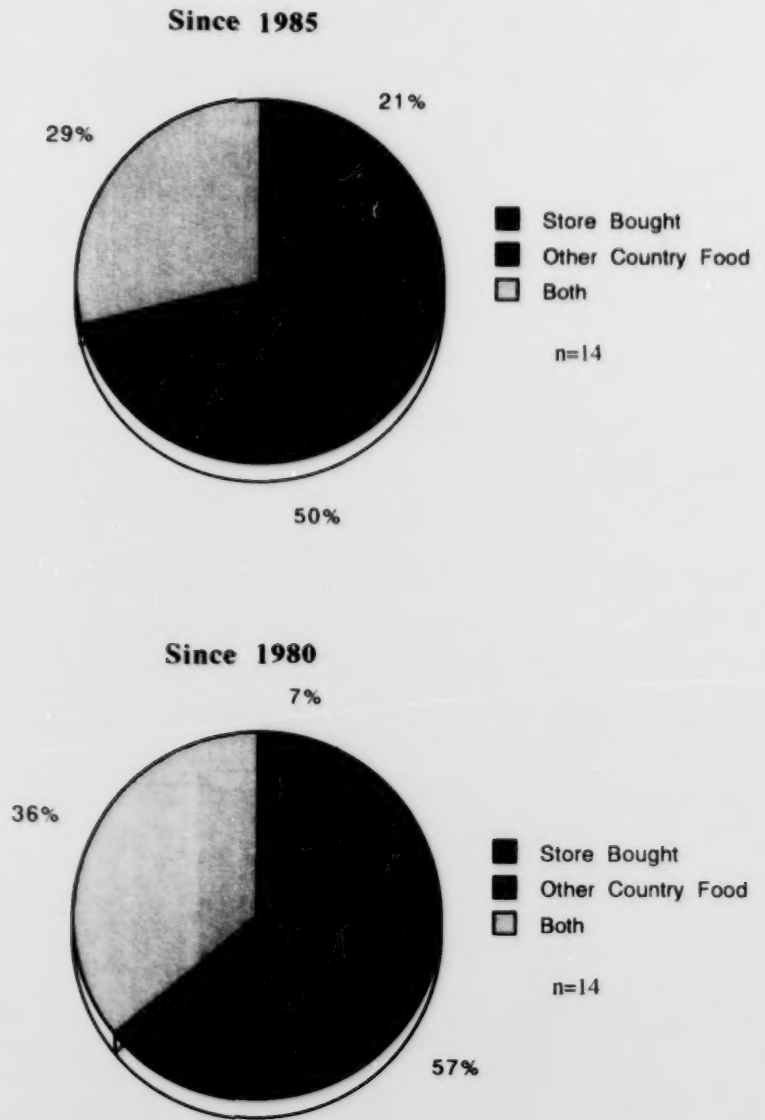


Figure 8: Alternate foods replacing fish in diet (suggested).

3.3 The Fishery

3.3.1 Participation in the Fishery

Participation in the fishery was high among the households in this study. Of the 202 households surveyed, 94% had fished during the previous two years. This is, of course, not surprising, as the stratified selection procedure was designed to target households participating in the domestic fishery. Essentially all of the households had fished during the past two years in all communities except Fort Simpson. In Fort Simpson, only about two thirds of the households had fished during the past two years. This appears to be consistent with the relatively large, urban nature of this community, and the failure to identify any active, serious fishing households in the stratified sample selection in Fort Simpson.

In all of the communities, those households that were not direct participants in the domestic fishery, were nevertheless involved through the domestic exchange of fish. These households obtain fish from the domestic fishery, in about three quarters of the cases, from relatives and friends and from Hunter & Trapper Associations (HTAs) in the remaining one quarter.

3.3.2 Changes in Fishing Activity

The amount that households are fishing has changed somewhat over the past eight years. Figure 9 suggests that while the majority felt that they are fishing about the same amount, about one quarter of the households are fishing less than they did three years before and one third are fishing less than they did eight years before.

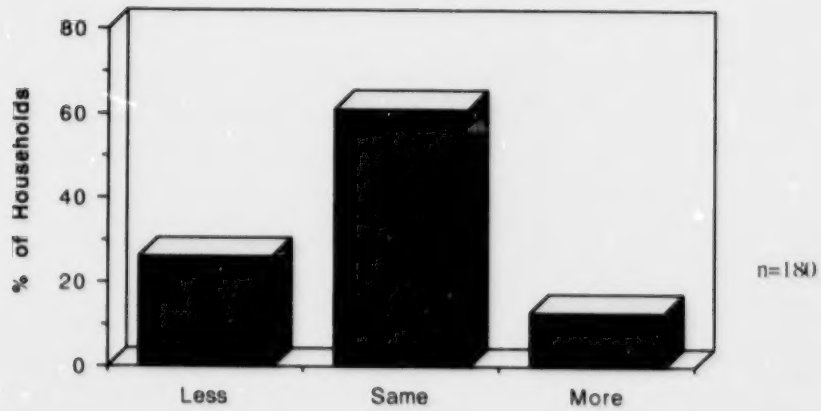
Of all the households that are fishing less, the greatest proportion is from Fort Good Hope. Residents from Fort Good Hope accounted for about one third of the households that fish less than they did three years previously. Of households fishing less compared to eight years before, about one quarter were residents of Fort Good Hope.

Various reasons were offered by some of the households for their reduced fishing activity compared to three and eight years ago. Their explanations are grouped into common thematic categories and are presented in Figure 10. Of households reporting reduced fishing activity since 1985, most commonly (41%) they attributed this to having less time for domestic fishing activities (eg. wage employment, less time on the land, busy with meetings

or school). The second most common (30%) reason cited for fishing less was that they are keeping fewer dogs and thus do not need to fish as much. However, the situation was reversed when compared to 1980, with reduced fishing being most commonly attributed to keeping fewer dogs (46%) and to less time for domestic fishing activities (27%). Other reasons for reduced fishing activity compared to three and eight years ago were boat and motor problems (14-15%), belief that the fish are contaminated (7-9%) and that the individuals are getting too old to fish (5%). Thus, there were two principal factors contributing to reduced domestic fishing:

- the trend since 1980 towards keeping fewer dogs; and
- the increasing importance of non-domestic fishing activities in their daily lives, particularly since 1985.

Fishing Activity in 1988, Compared to 1985



Fishing Activity in 1988, Compared to 1980

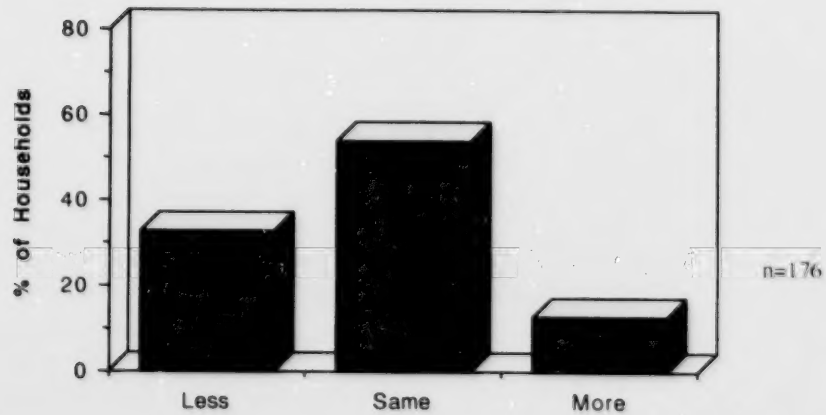


Figure 9: Change in fishing activity.

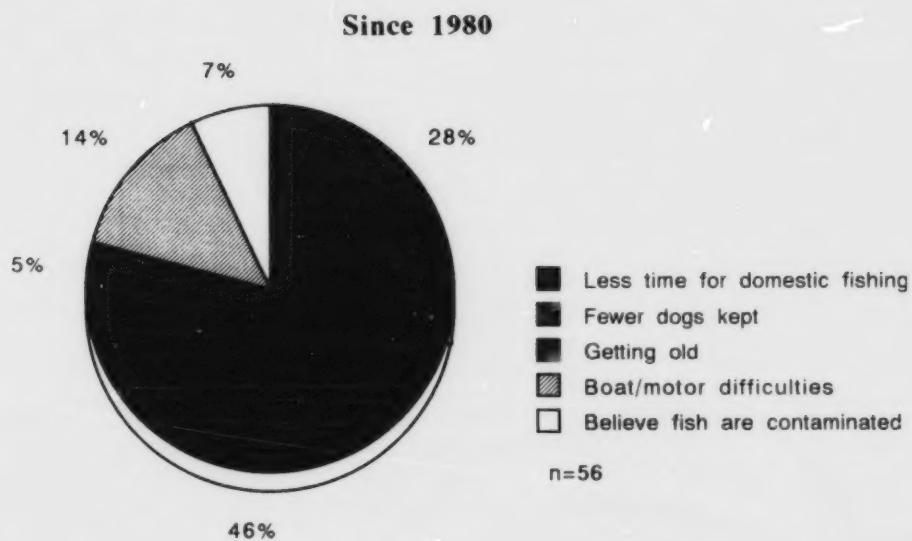
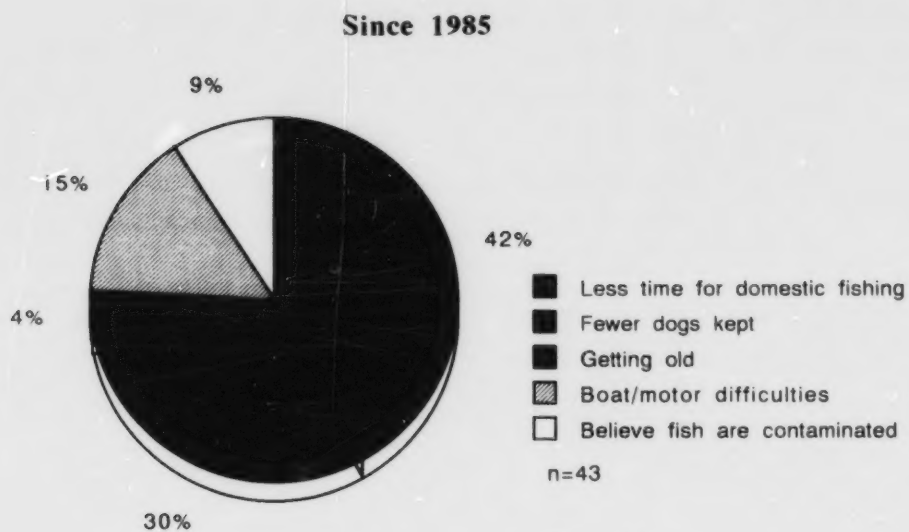


Figure 10: Reasons for reduced fishing activity.

3.3.3 Fishing Method

Net fishing was the method used by most of the households in all seasons. Figure 11 shows that between 89% and 96% of the households used nets, depending on the season. A few households (<8%) used lines exclusively (either lines set under the ice or angling) and fewer still (<4%) fished with both nets and lines. Fishing with lines was most common during the summer, largely as a result of angling for lake trout and grayling by households in lake communities such as Fort Franklin.

In general, nearly all of the fishing for most of the species was by net, with the exception of lake trout and grayling in the spring and summer, lake trout and burbot in the fall and burbot in the winter. In the spring, between one quarter and one third of the households fishing for lake trout caught them by line, and about one half of the households fishing for grayling caught them by line. In the summer, between one quarter and one half of the lake trout-fishing households used lines. Most (about three quarters) used lines for grayling. In the fall about one quarter of the households fishing for lake trout and burbot indicated that they used either lines or nets and lines to catch these species. In the winter, a few households (10-17%) reported that they used lines to catch burbot.

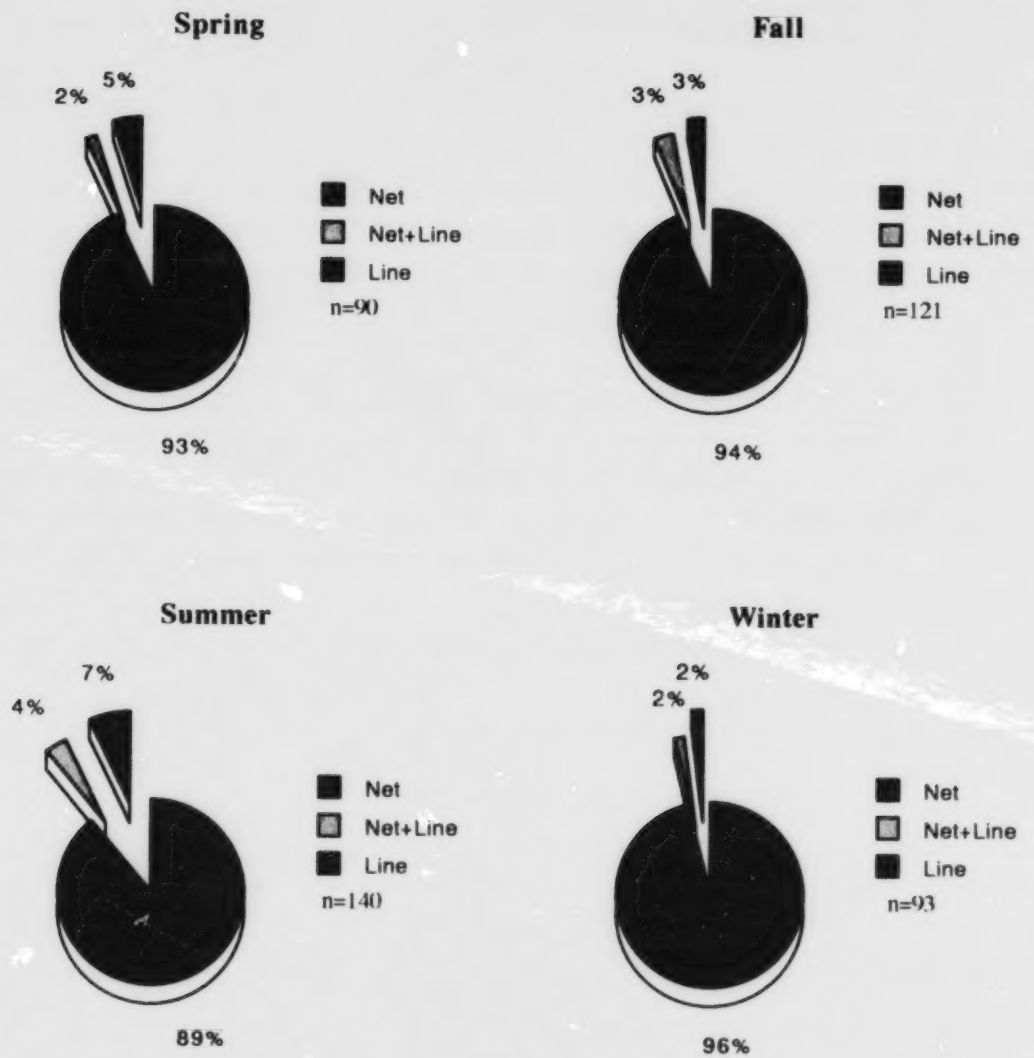


Figure 11: Fishing methods used in each season.

3.3.4 Species Composition of the Fishery

Between 10 and 13 species were caught in the domestic fishery, depending on the season and locality. These species were:

- lake whitefish, Coregonus clupeaformis;
- broad whitefish, Coregonus nasus;
- Arctic cisco, Coregonus autumnalis*;
- lake cisco, Coregonus artedii;
- inconnu, Stenodus leucichthys;
- lake trout, Salvelinus namaycush;
- Arctic charr, Salvelinus alpinus;
- Arctic grayling, Thymallus arcticus;
- chum salmon, Oncorhynchus keta;
- northern pike, Esox lucius;
- longnose sucker, Catostomus catostomus;
- white sucker, Catostomus commersoni;
- burbot, Lota lota;
- walleye, Stizostedion vitreum.

The relative numbers of households catching each species is shown in Figure 12 for each season. Figure 12 shows that the most commonly caught species were lake whitefish and broad whitefish in the spring, summer and fall, with between 44 and 57% of the households catching these fish. During these three seasons, inconnu were also caught by many (30%-53%). Most households fished for and caught several species. In the winter, the most commonly caught species were lake whitefish, broad whitefish, lake trout and burbot. Compared to the other three seasons, the lower absolute proportions of households catching each species in the winter shows that, in general, each household caught fewer species. Relatively few (or none) of the households caught walleye, Arctic grayling, Arctic charr, white sucker or chum salmon .

Not all species were considered to be of the same relative importance to the households in this study. Figure 13, depicting the proportion of household that reported each species to

* May also include least cisco, Coregonus sardinella

be of primary importance to them, shows that of all the species caught, only three were considered to be of primary importance by many of the households. In order of the proportion of households reporting each species to be of primary importance, these species were:

- broad whitefish;
- lake whitefish; and
- lake trout.

In all seasons, broad whitefish was the species most often cited as being of principal importance in the fishery. Fewer than 5% of the households reported that inconnu, northern pike, longnose sucker, burbot, cisco, walleye, Arctic grayling, Arctic charr, white sucker or salmon were the most important species.

3.3.4.1 North Mackenzie, River Communities

The species caught in the river fishery of north Mackenzie communities are shown in Figure 14 for the each season. This fishery was composed principally of the following six species:

- broad whitefish;
- lake whitefish;
- inconnu;
- northern pike;
- burbot; and
- cisco, (presumably Arctic cisco or least cisco based on species distribution described by Scott and Crossman (1973)).

Broad whitefish dominated the fishery, being caught by essentially all of the north Mackenzie river-fishing households. As can be seen in Figure 14, the species caught depended somewhat on the season. In the spring, the fishery was largely for broad whitefish. Inconnu, burbot, lake whitefish, northern pike and cisco were also caught by many households. The summer fishery was composed largely of broad whitefish and inconnu. Almost all of the households caught these two species. Cisco and lake whitefish were also caught by many of the households. In the fall, most households caught broad whitefish, lake whitefish and inconnu. Many also caught burbot and cisco. During the

winter fishery, most of the households caught fewer species than in the other seasons. The winter fishery was composed largely of broad whitefish and burbot. More households fished for burbot during the winter fishery than in any other season.

While many of the north Mackenzie river-fishing households caught a variety of species, Figure 15 shows that broad whitefish was nearly unanimously considered to be the most important species in the fishery in all seasons.

3.3.4.2 South Mackenzie, River Communities

The species caught by river-fishing households in the south Mackenzie are shown in Figure 16. The fishery was composed principally of the following eight species:

- broad whitefish;
- inconnu;
- northern pike;
- longnose sucker;
- lake trout;
- burbot;
- walleye; and
- grayling.

Too few households fishing rivers in the south Mackenzie River area provided information about the species composition of the fishery to draw conclusions about seasonal differences. Similarly, the relative importance of the species to the households cannot be definitively determined. However, Figure 17 suggests that broad whitefish was the species of primary importance to households fishing rivers in the south Mackenzie River area.

3.3.4.3 North Mackenzie, Lake Communities

Figure 18 shows the species caught by households fishing lakes in the north Mackenzie River area. As can be seen, the fishery was dominated in all seasons by lake trout. Nearly all of the households caught lake trout in each of the seasons. Other species were caught, including the following species:

- lake whitefish;
- lake trout;
- cisco (presumably lake cisco based on species distribution as described by Scott and Crossman (1973)); and
- grayling.

In each of the fishery seasons, lake trout was overwhelmingly considered to be the species of primary importance (Figure 19).

3.3.4.4 South Mackenzie, Lake Communities

Figure 20 shows the species composition of the fishery for households fishing lakes in the south Mackenzie River area. Many species were caught and most households fished for several species. The main species caught in the fishery were:

- lake whitefish;
- inconnu;
- northern pike;
- longnose sucker;
- lake trout;
- burbot; and
- walleye.

In all seasons, lake whitefish were caught by the greatest number of households. Lake whitefish were nearly unanimously considered to be the species of primary importance in all seasons (Figure 21).

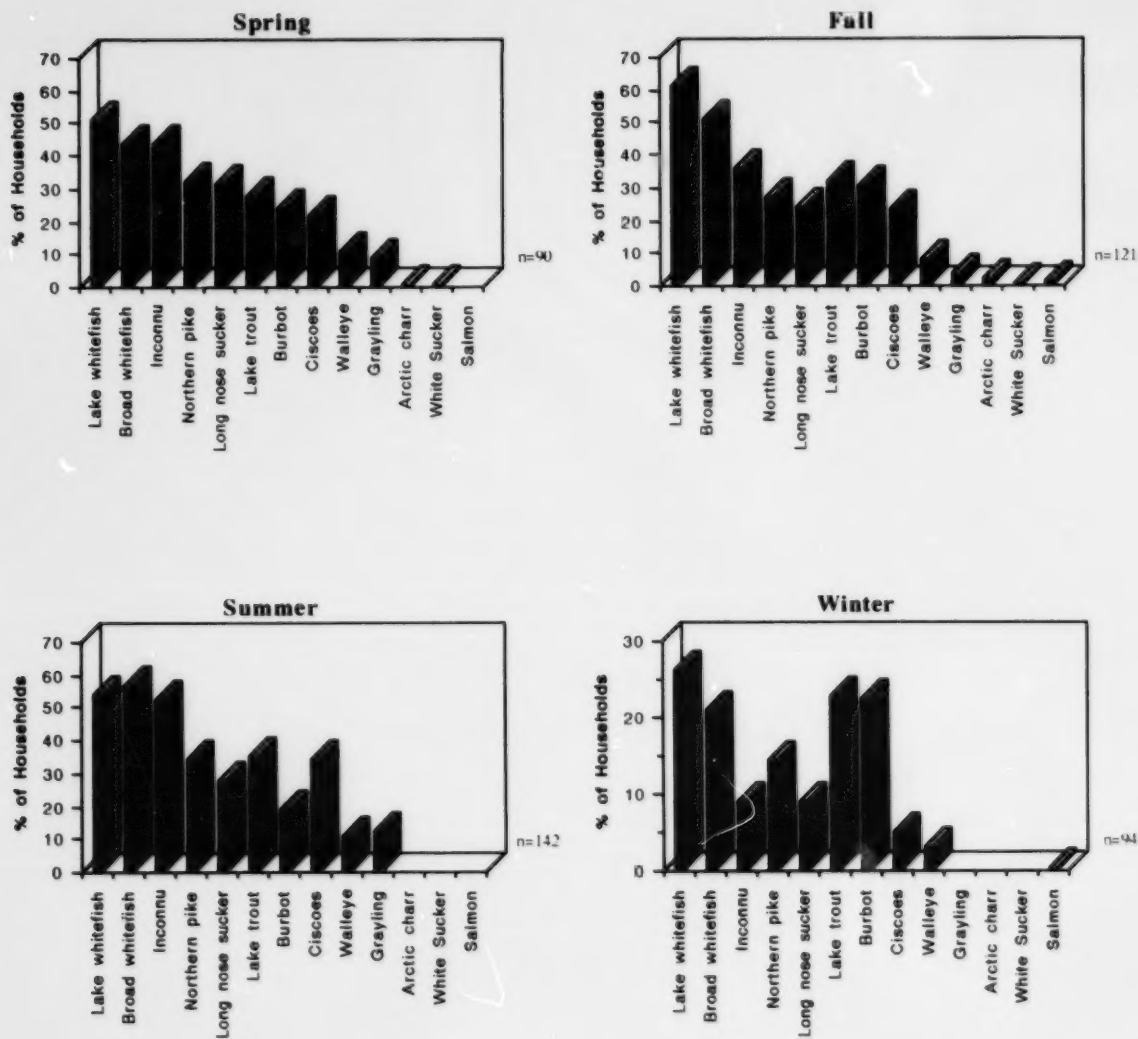


Figure 12: Overall species composition of the spring, summer, fall and winter fisheries, of the Mackenzie River Valley.

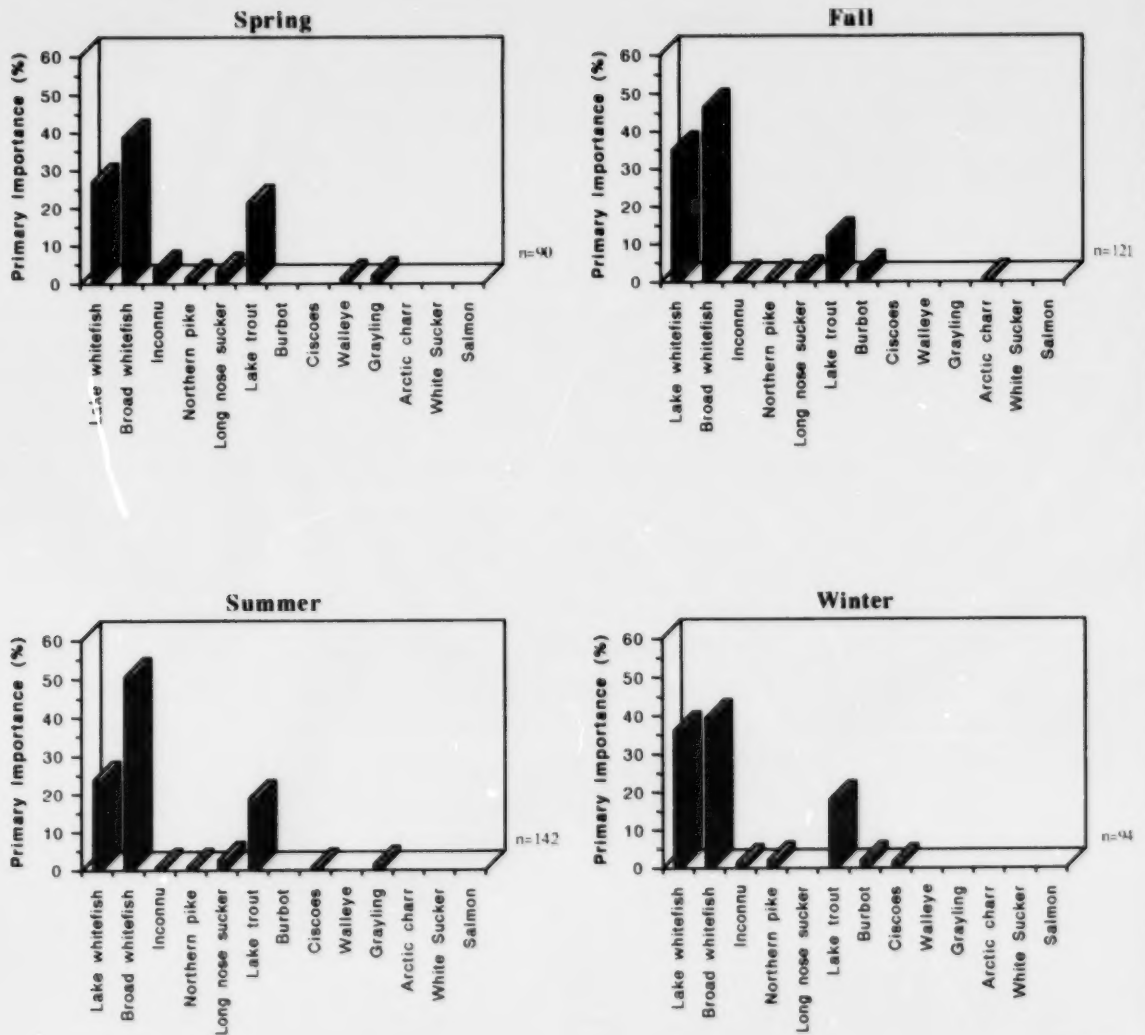


Figure 13: Overall primary importance of species in the spring, summer, fall and winter fisheries, of the Mackenzie River Valley.

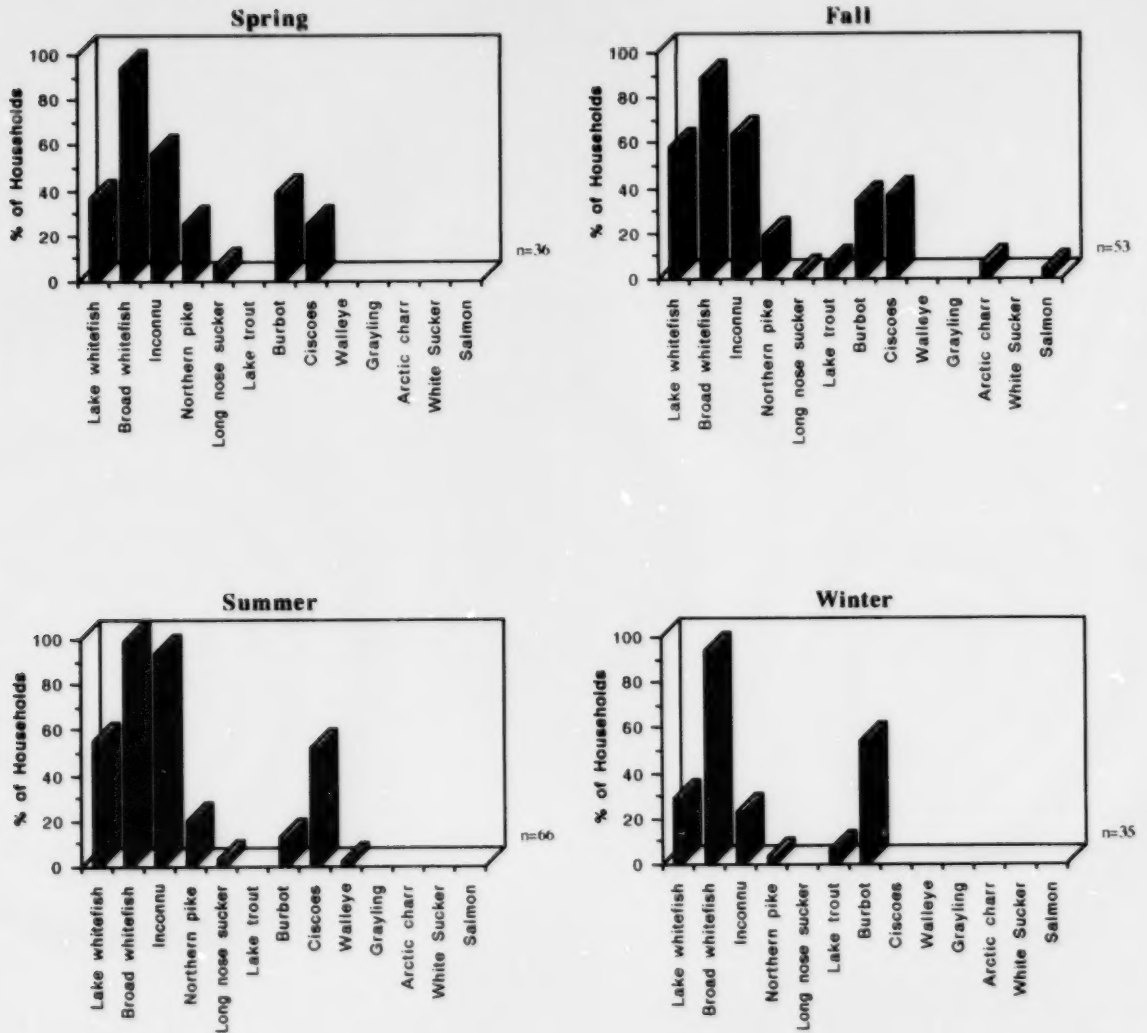


Figure 14: Species composition of the river fishery of the north Mackenzie River region.

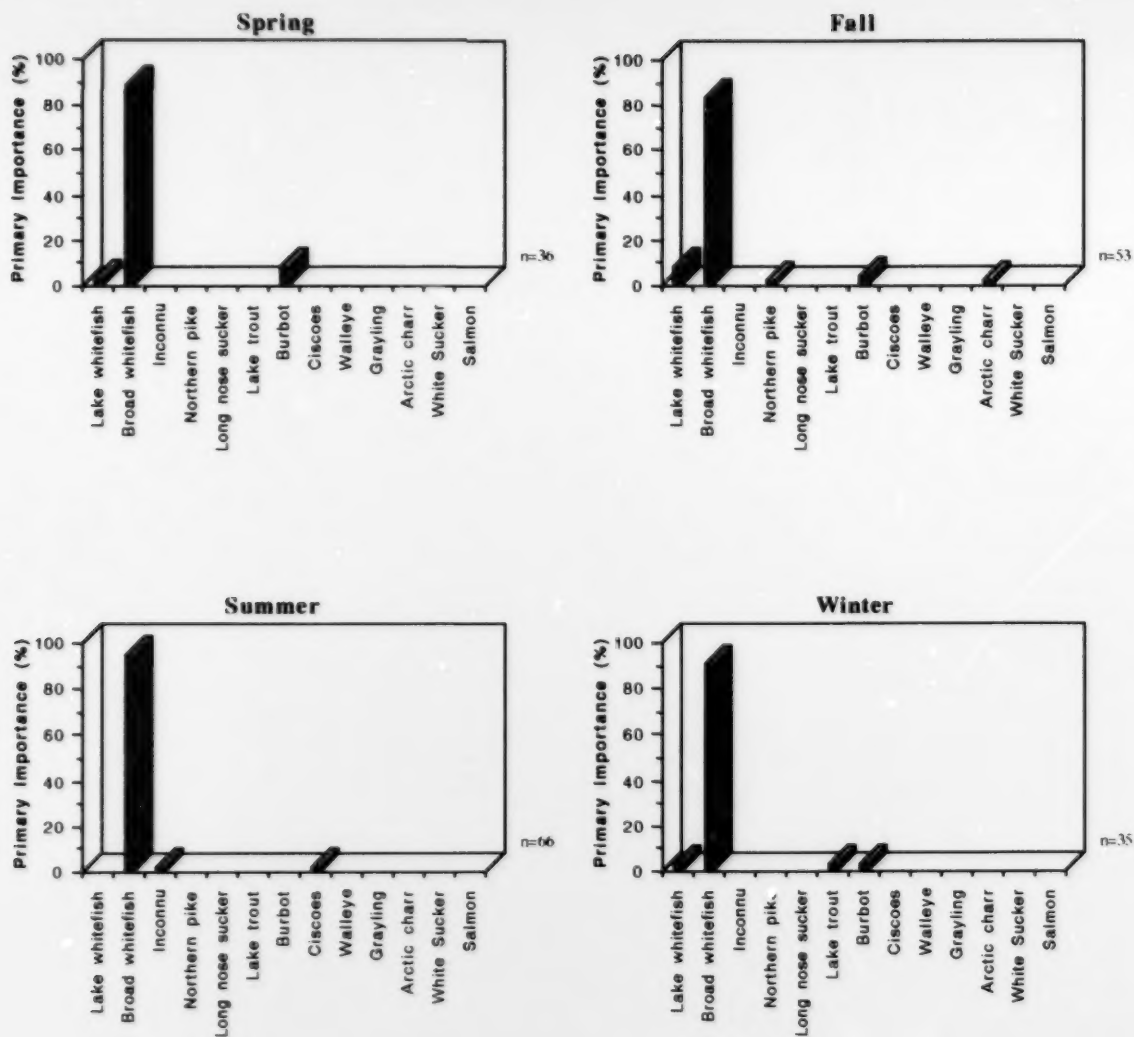


Figure 15: Primary importance of species in the river fishery of the north Mackenzie River region.

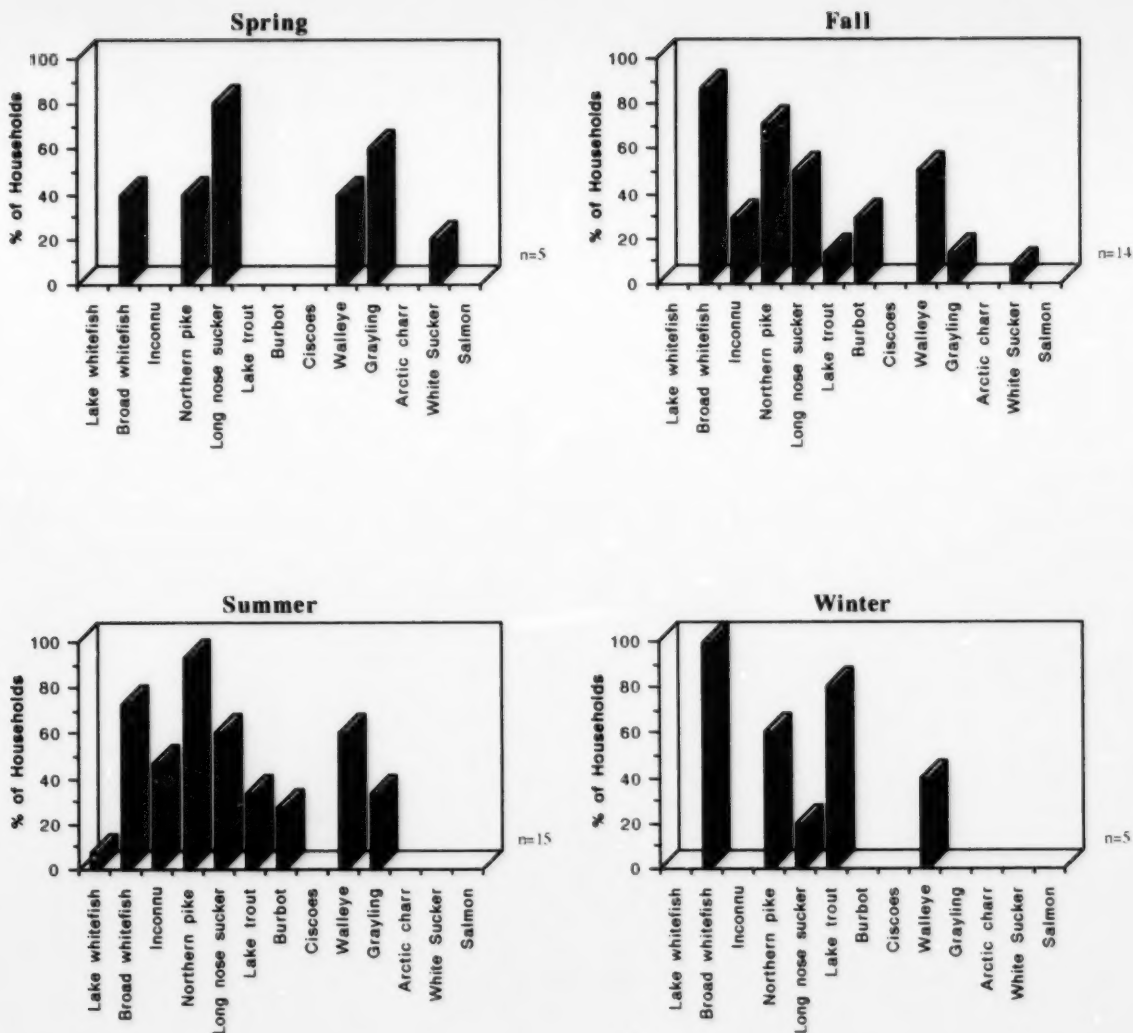


Figure 16: Suggested species composition of the river fishery in the south Mackenzie River region.

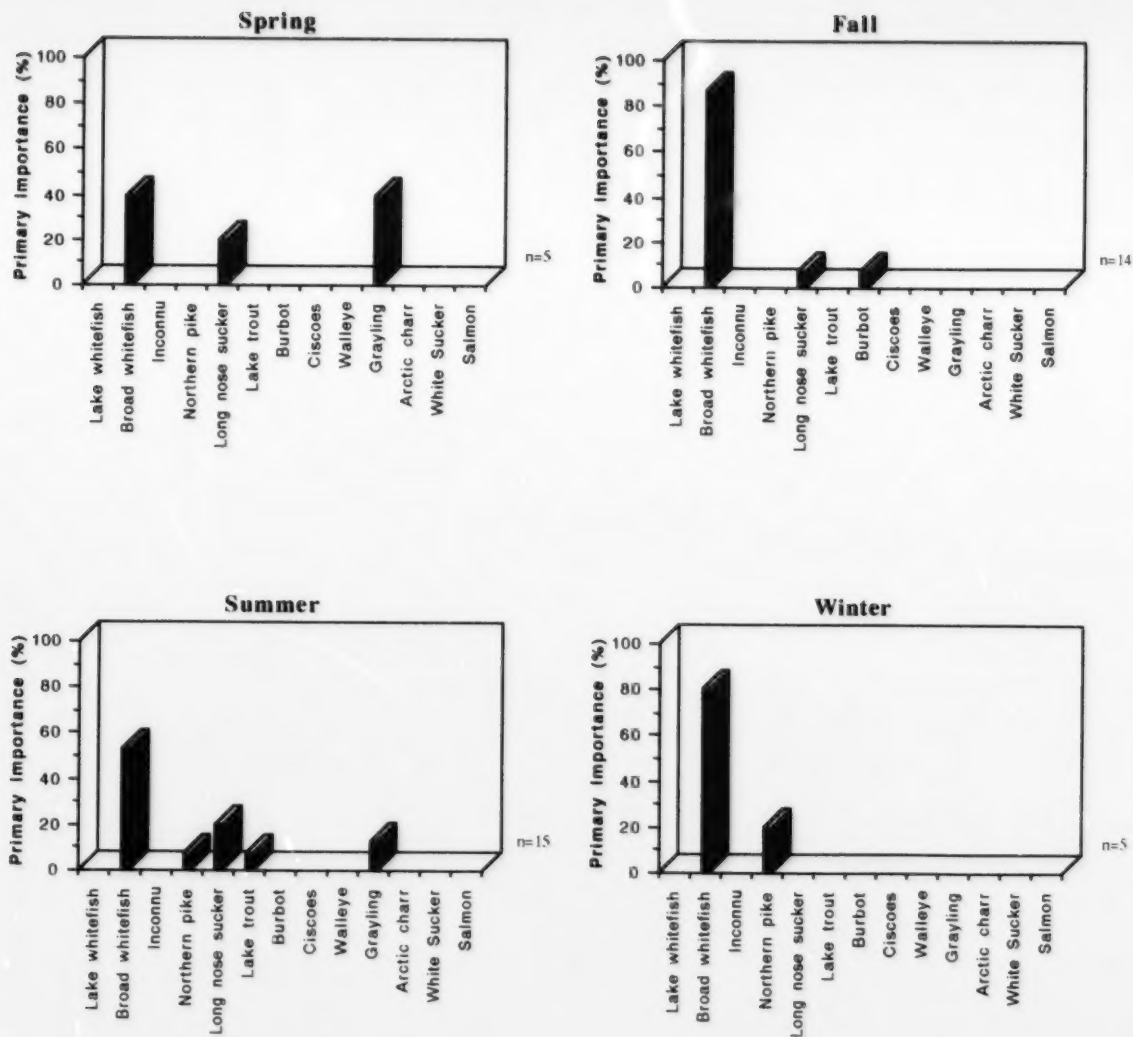


Figure 17: Suggested primary importance of species in the river fishery of the south Mackenzie River region.

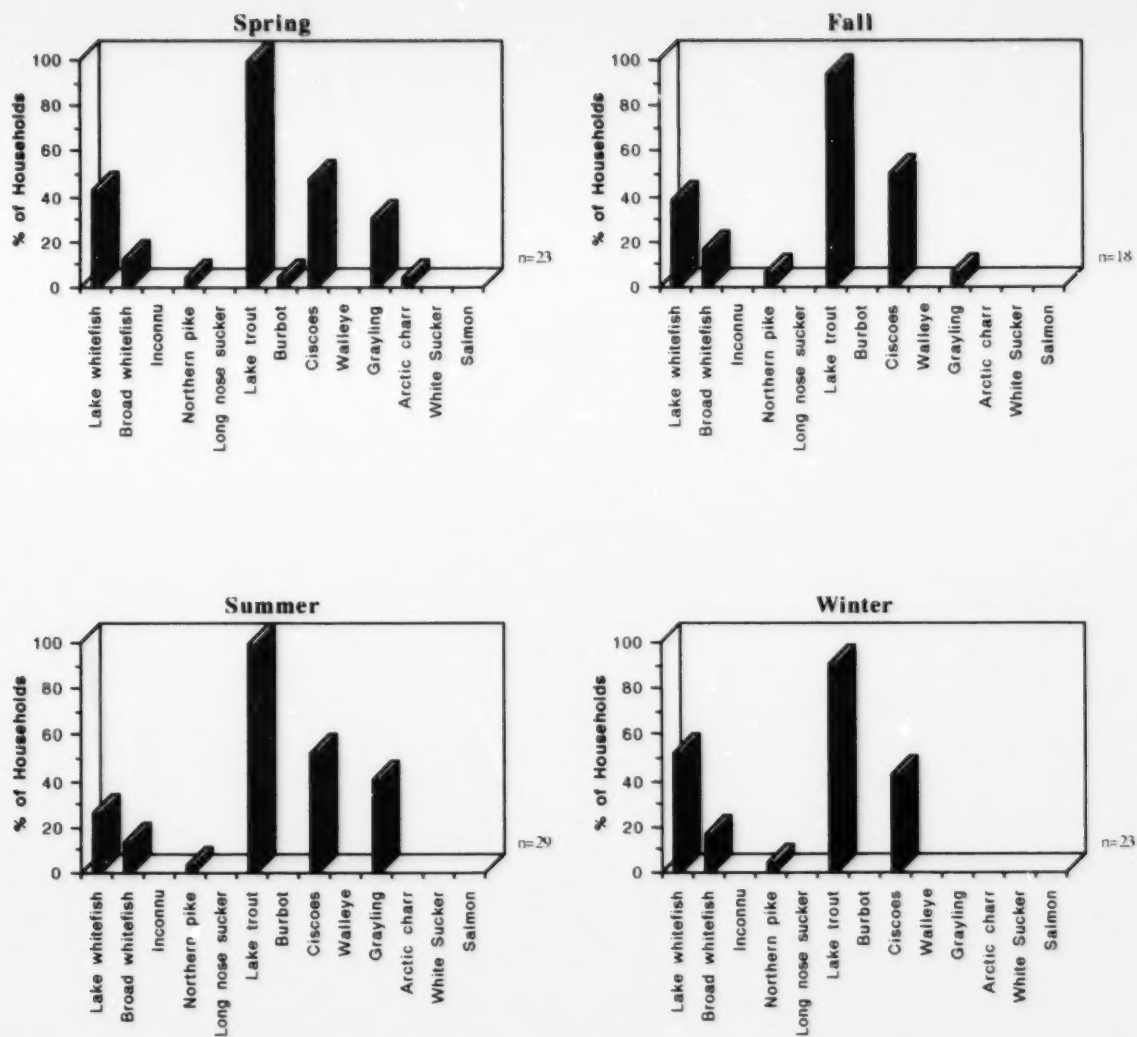


Figure 18: Species composition of the lake fishery in the north Mackenzie River region.

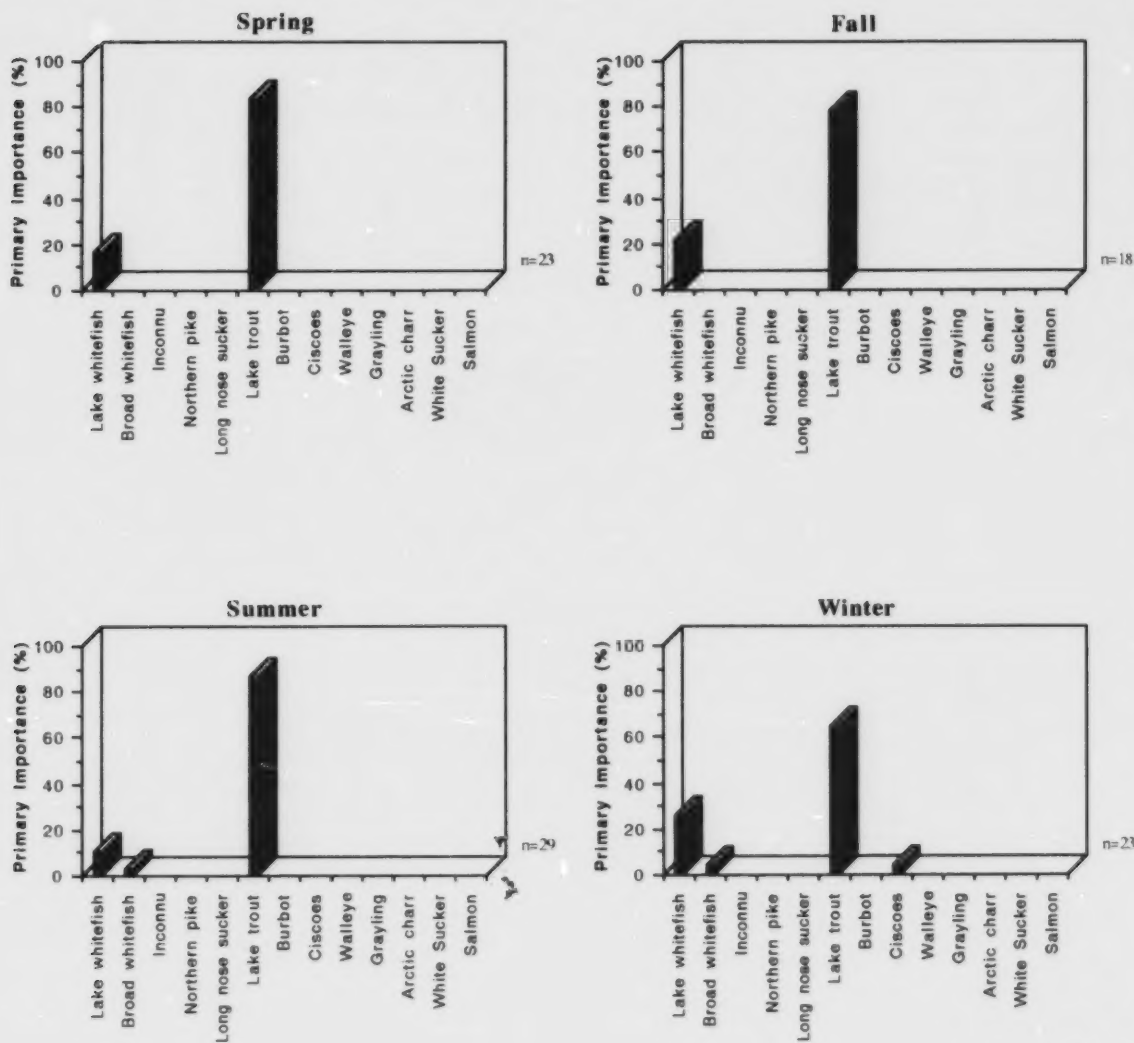


Figure 19: Primary importance of species in the lake fishery of the north Mackenzie River region.

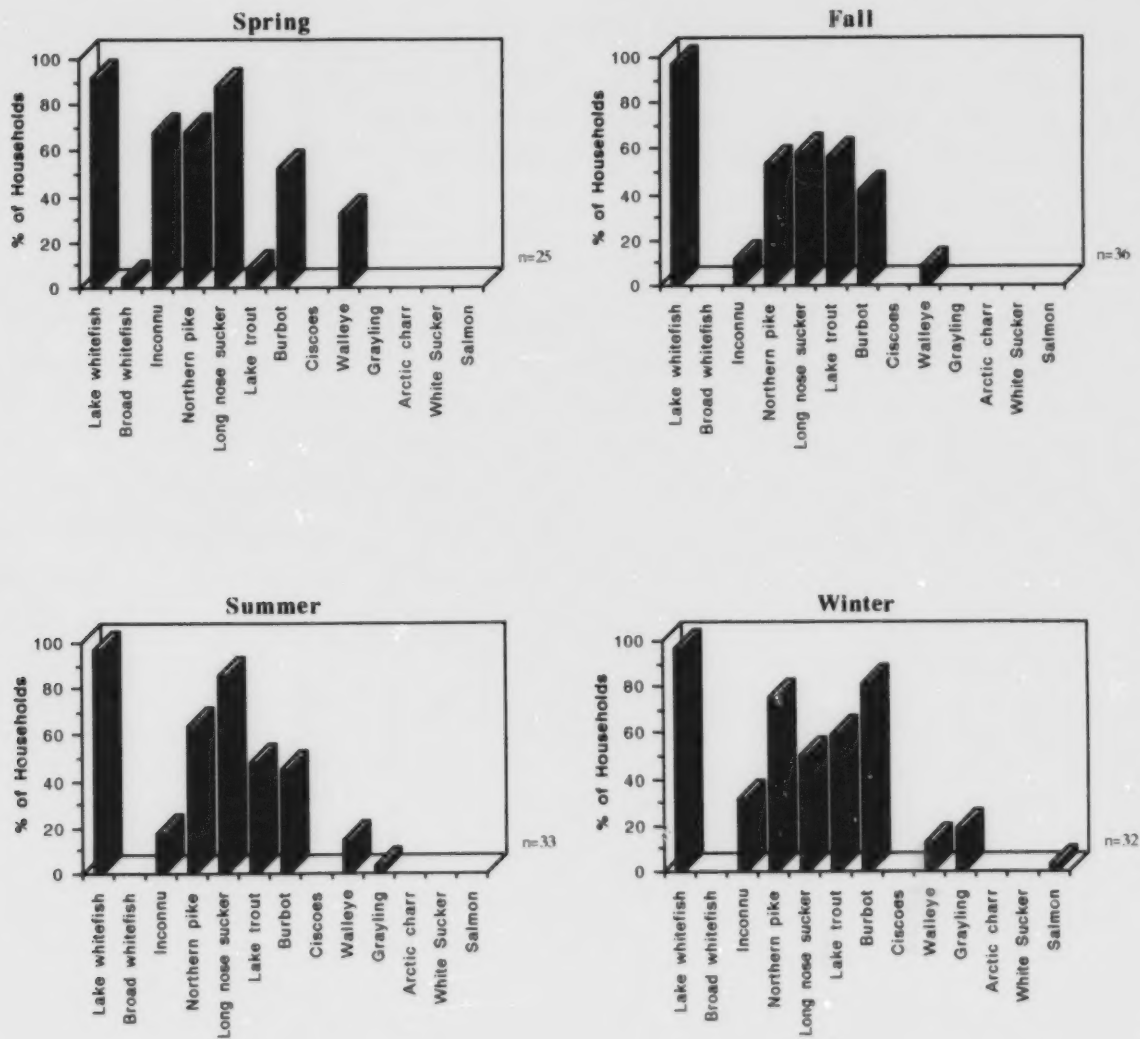


Figure 20: Species composition of the lake fishery for the south Mackenzie River region.

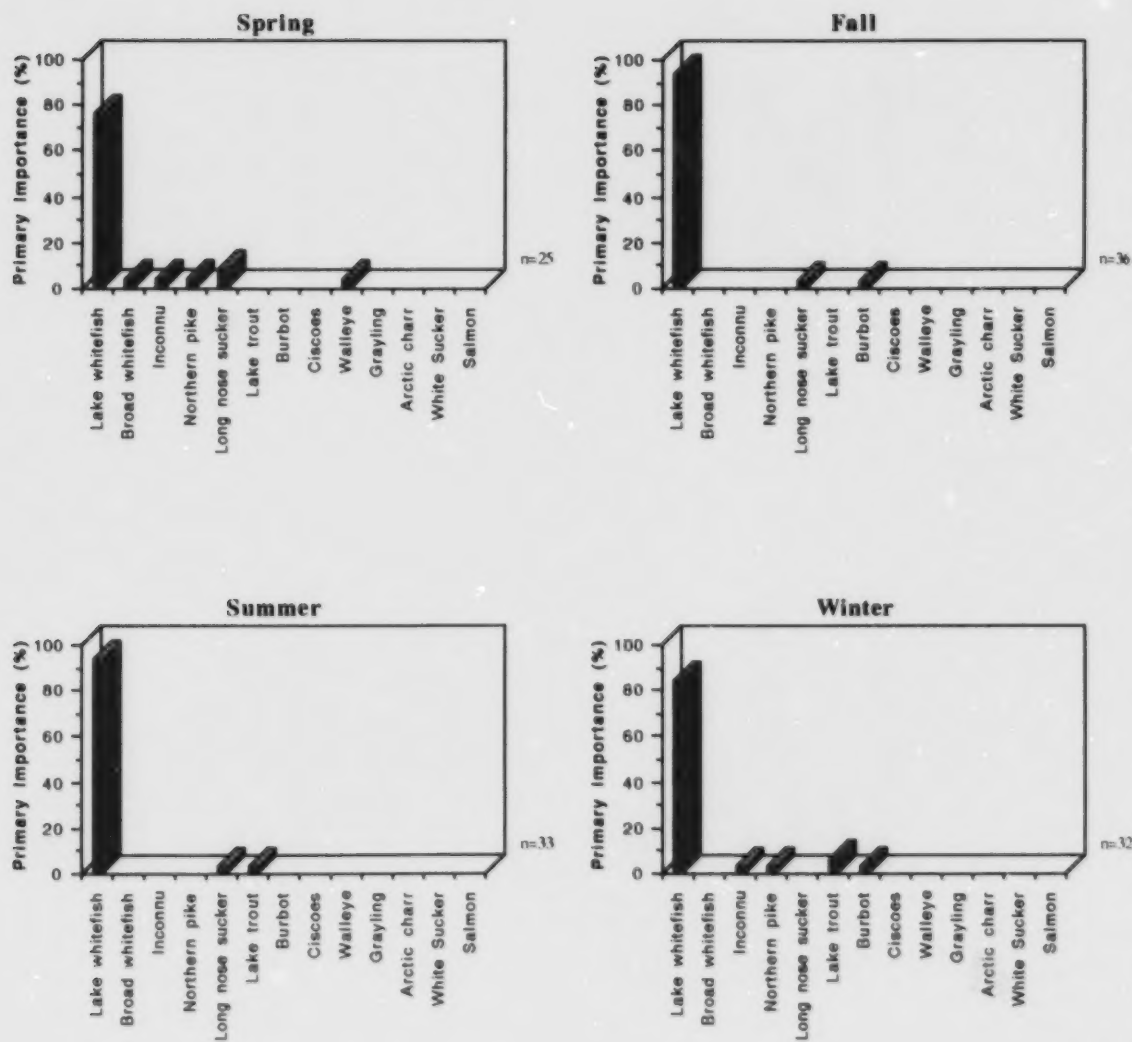


Figure 21: Primary importance of species in the lake fishery of the south Mackenzie River region.

3.3.5 Duration of the Fishery

The domestic fishery in and near the Mackenzie River watershed occurs throughout most of the year. Figure 22 shows the months fished during each of the "spring", "summer", "fall" and "winter" fisheries. The lowest participation in the fishery is during March, April and May with April being the month during which the fewest households fish.

The spring fishery occurs principally during May and June (Figure 22). Most of the spring fishing occurs during June, with about 70% of the households fishing during this month. In addition, just under one half (47%) of the households fished during May. Overall, about one half of the households in this study usually fish in the spring fishery. This rate of participation varied from community to community, ranging from approximately one fifth of the households surveyed in Fort Good Hope and Fort Simpson to all of the surveyed households in Wrigley and Lac La Martre. The proportion of households that actually fished in the spring of 1988 (45%) was similar to the usual rate of participation in the spring fishery. On average, the number of weeks that the households actually fished during the spring ranged from two weeks in south Mackenzie river-fishing households to five in south Mackenzie lake-fishing households, as is shown in Figure 23. Overall, the average number of weeks fished during the spring was 4.0 (Figure 24).

Fishing during the summer occurs mainly in July and August (Figure 22), with 80% to 86% of summer fishing households fishing during these months. About three quarters (73%) of the households usually fish during the summer. This rate of participation ranged from about one third of the surveyed households in Fort Simpson to all of the surveyed households in Colville Lake, Dettah, and Jean Marie River. Approximately 70% of the households actually fished during the summer of 1988. This proportion was similar to the usual rate of participation in the summer fishery. On average, the households fished about nine weeks in all regional fisheries except the north Mackenzie river fishery (Figure 23). These households fished for about seven-and-a-half weeks. Overall, the average number of weeks fished in the summer was 8.0 (Figure 24).

Fishing during the fall occurs mainly during September and October. As depicted in Figure 22, 92% of the fall-fishing households fished during September and 63% fished during October. The rate of participation in the fall 1988 fishery (60%) was essentially no different from the usual. The duration of the fishery ranged from an average of three weeks in the south Mackenzie river-fishery to five-and-a-half weeks in the north Mackenzie lake-

fishery (Figure 23). On average, the households fished for 4.6 weeks in the fall (Figure 24).

Fishing during the winter occurred over a longer period, with between 39% and 67% of the households fishing sometime during October to March (Figure 22). Most commonly, fishing occurred during November (67% of households), December and January (53%-54%). The proportion of households (50%) fishing during the winter of 1987/1988 was essentially the same as usual. The average number of weeks fished in the winter ranged from five-and-a-half in the north Mackenzie river-fishery to eighteen in the south Mackenzie river-fishery. Overall, the households fished an average of 11 weeks in the winter (Figure 24).

The domestic fishery occupied a substantial proportion of the year for all of the communities in this study. Figure 25, showing the average number of weeks per year devoted to the fishery (by fishing area), suggests that at least one half of the year was occupied with domestic fishing in the north Mackenzie river-fishery and about two-thirds of the year in the south Mackenzie river-fishery, north Mackenzie lake-fishery and south Mackenzie lake-fishery. Overall, an average of 27.6 weeks were devoted to the domestic fishery in the Mackenzie River Valley.

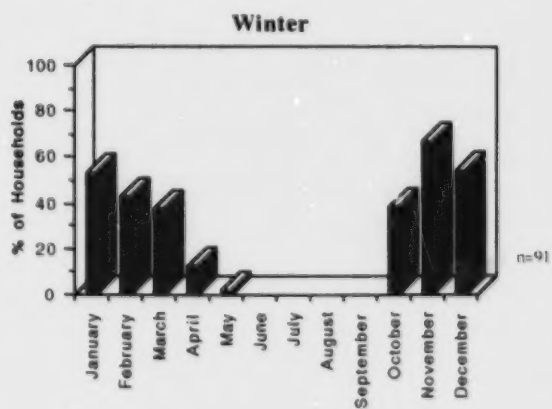
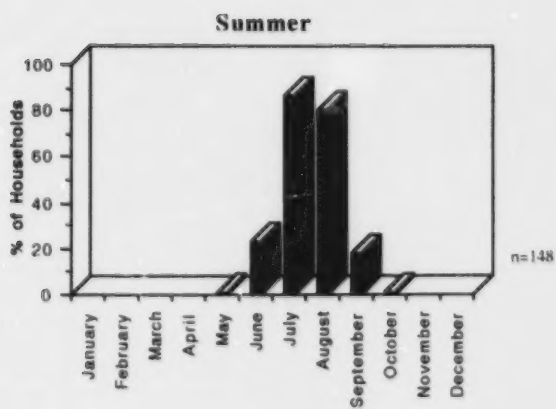
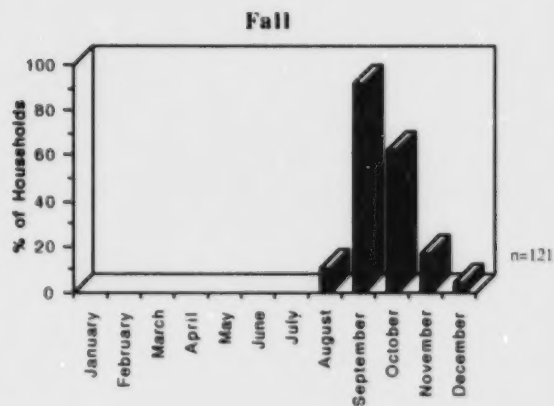
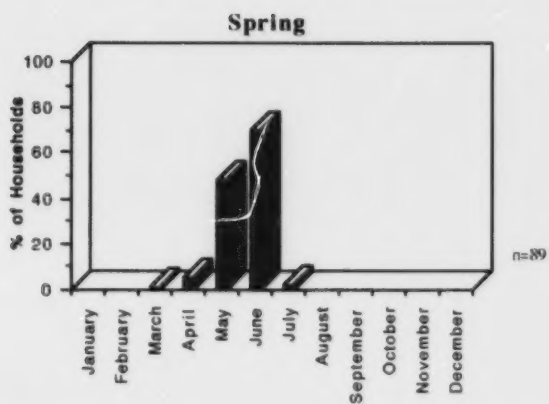


Figure 22: Months of the fishery.

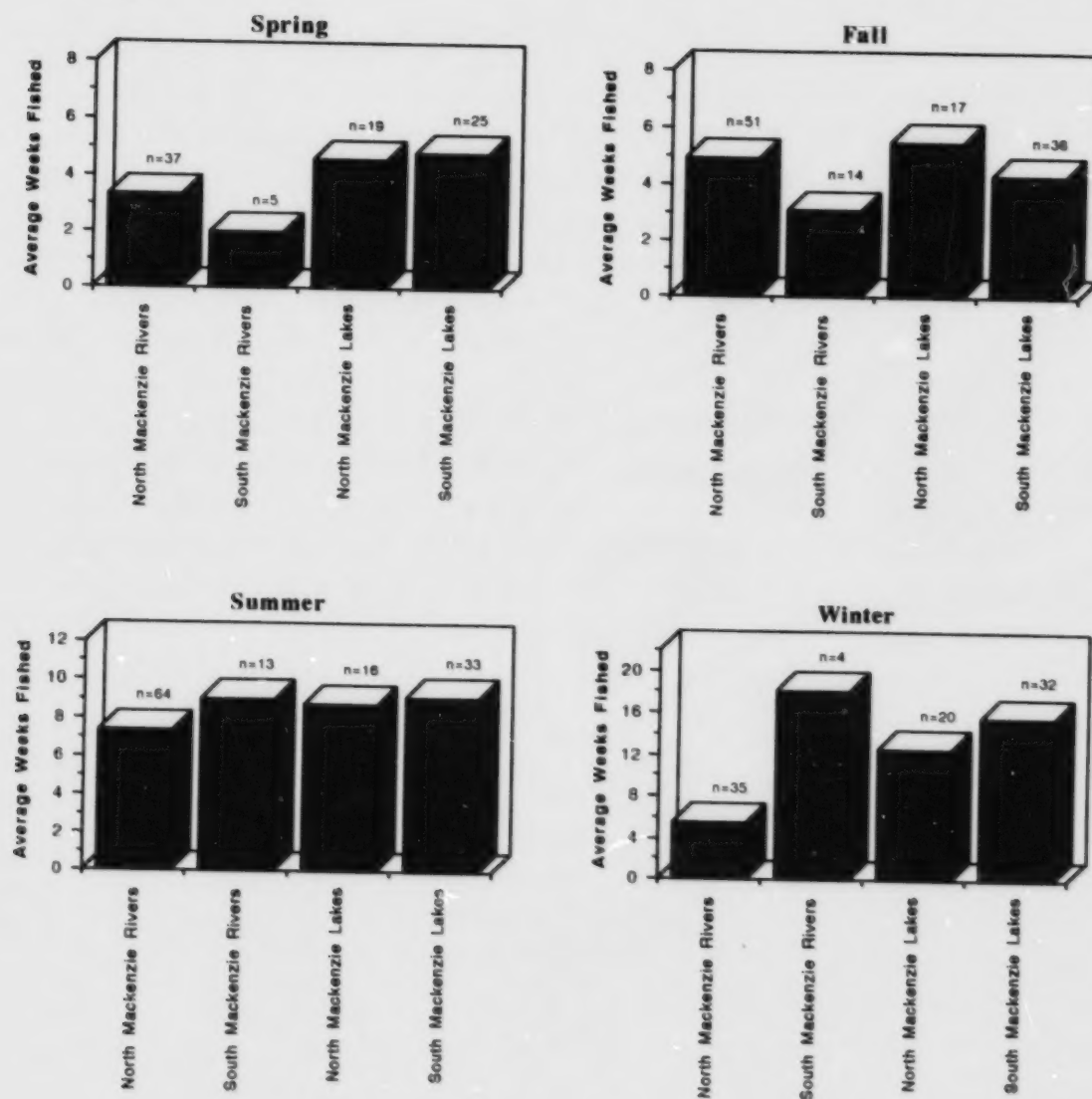


Figure 23: Average number of weeks fished in each regional fishery during the spring, summer, fall and winter fisheries.

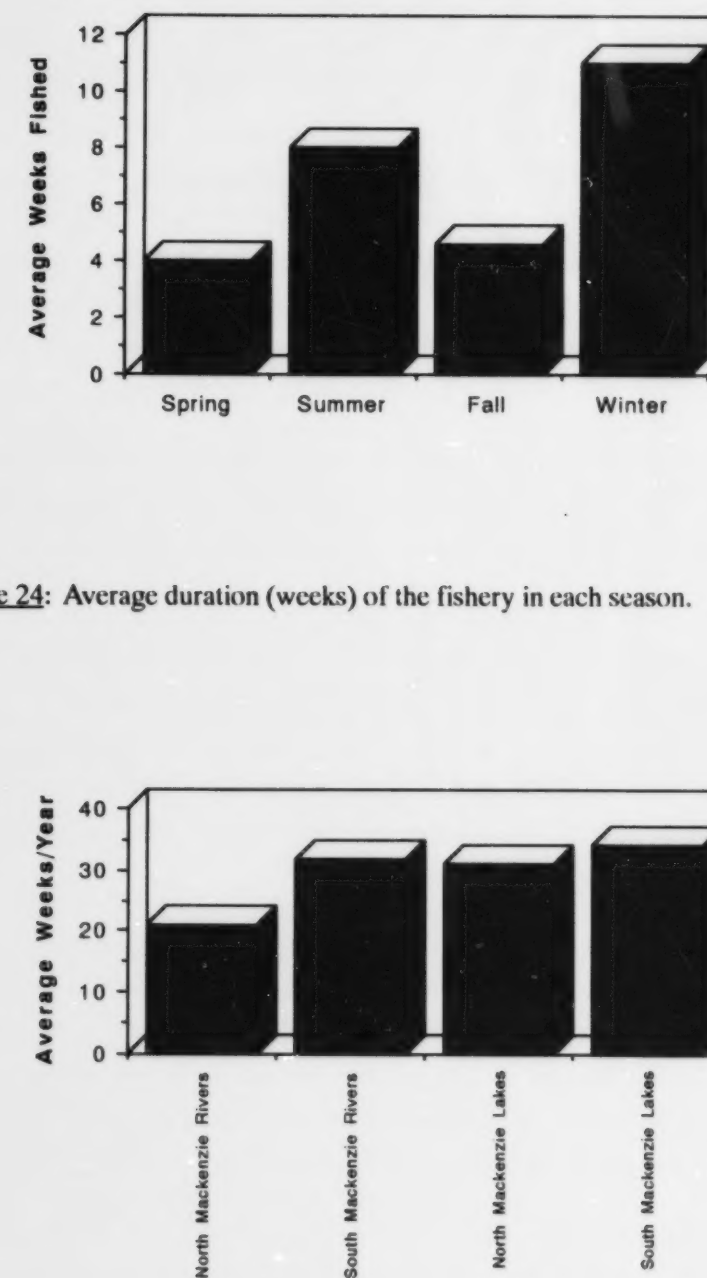


Figure 24: Average duration (weeks) of the fishery in each season.

Figure 25: Average yearly duration of the fishery in each fishing region.

3.3.6 Fishing Effort

An aggregate index was developed to describe some aspect of relative fishing effort devoted to the domestic fishery, by the households and communities in this study. This index was comprised of:

(#times gear checked per week • hours per day devoted to fishing activities • weeks fished)

In compiling this index, households that reported angling as their fishing method were excluded as no measures of time spent, or frequency of angling, were collected by the questionnaire. Information related to angling was compiled separately and is reported separately.

Based on the index of fishing effort for the net fishery, Figure 26 shows that the greatest degree of effort was devoted to fishing in the summer. This effort in the summer fishery was approximately 30% greater than in the winter and nearly twice that of the spring or fall.

Fishing effort by regional fishery for each season is shown in Figure 27. Variable and low rates of response make meaningful comparison between regions and between seasons difficult. On this basis, no clear differences in effort devoted to the domestic fishery are apparent between north and south Mackenzie river-fishing or lake-fishing communities. However, Figure 28, showing the annual average fishing effort, is suggestive of greater effort in north Mackenzie river-fishing households than south Mackenzie lake-fishing households.

Many north Mackenzie lake-fishing households (particularly from Fort Franklin) reported that they angled. This fishing activity peaked in the summer with over one third of the north Mackenzie lake-fishing households angling for their fish. These households angled, on average, about three hours per day for an average of six weeks during the summer. Thus the fishing efforts attributed by the net fishing index to this fishery likely underestimates the overall effort, particularly during the summer.

The amount of time that the "typical" household devoted each day to fishing activities such as setting gear, moving gear, cleaning fish and storing fish, was essentially the same in each season, ranging from 3.3 hours to 3.6 hours per day.

The average frequency that households tended their fishing gear was essentially constant (8.7-9.2 times per week) in the spring, summer and fall fisheries. Gear was checked about

The average frequency that households tended their fishing gear was essentially constant (8.7-9.2 times per week) in the spring, summer and fall fisheries. Gear was checked about two-thirds as frequently in the winter. On the basis of seasonal duration, hours fished per day and rate of gear tending, it would appear that the relatively greatest effort devoted to the summer fishery is largely a function of the length of the season, rather than to increased intensity (gear tending and hours spent) of fishing activity. Similarly, the importance in terms of effort of the winter fishery is largely a consequence of the length of the season, moderated by somewhat reduced intensity of fishing.

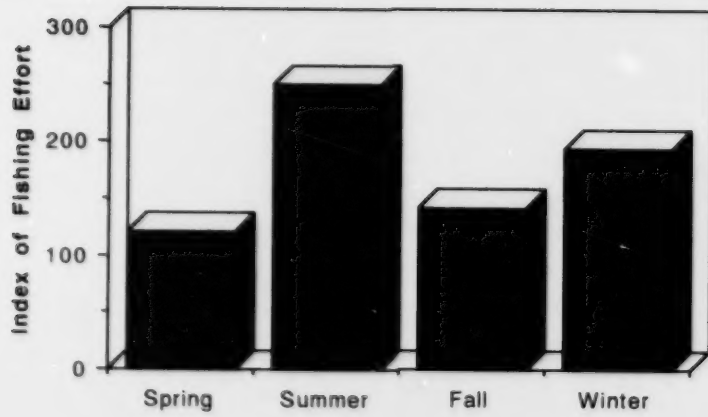


Figure 26: Relative fishing effort in each season.

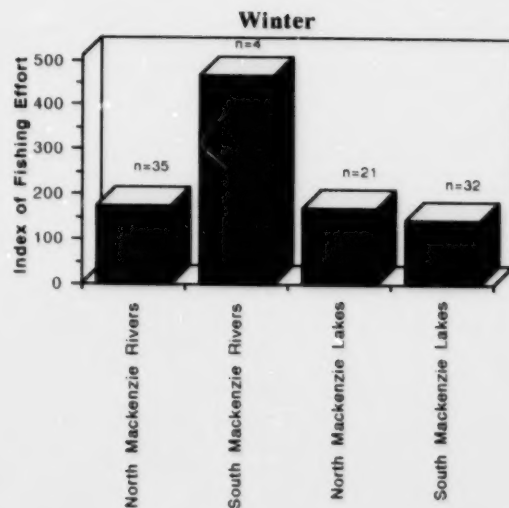
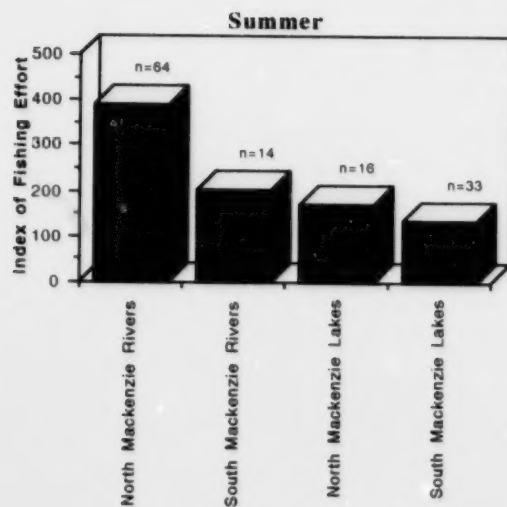
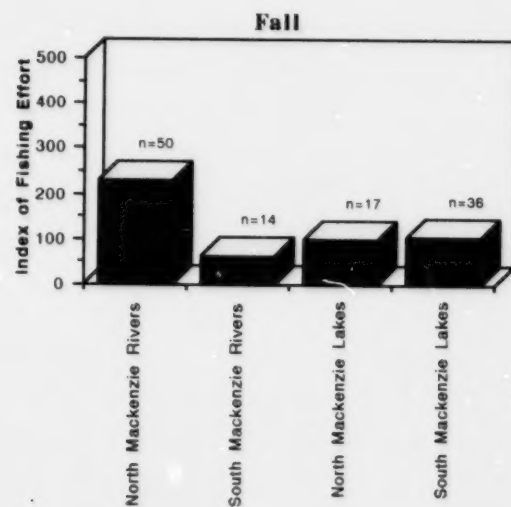
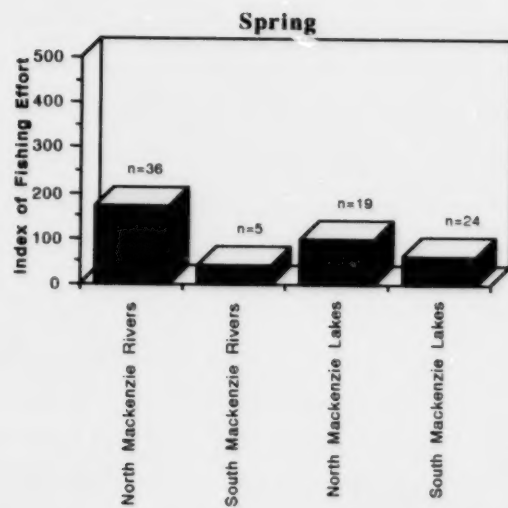


Figure 27: Relative fishing effort for each regional fishery, in each season.

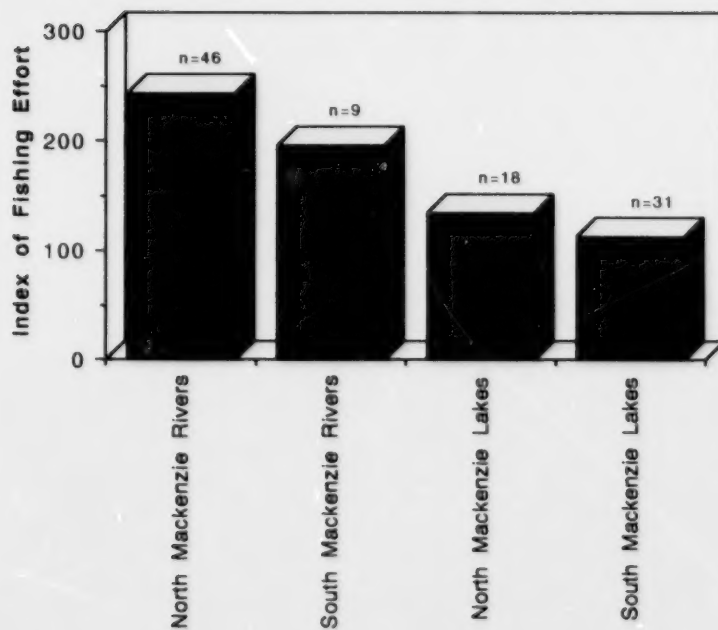


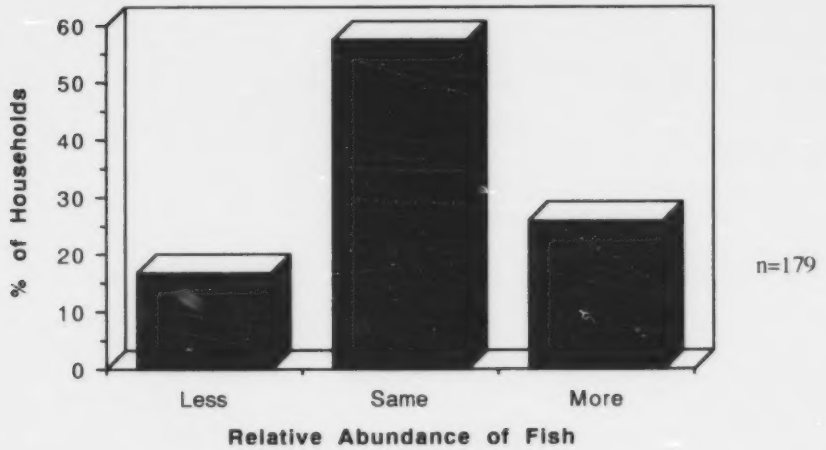
Figure 28: Average annual relative fishing effort for each regional fishery. Note: “n” values reported as average of sample size in the spring, summer, fall, and winter fisheries in each region.

3.3.7 Perceived Abundance of Fish

Household perception of the abundance of fish in 1988, as compared to three and eight years prior, is generally neutral, as shown in Figure 29. Most commonly, the households felt that there was about the same number of fish in 1988 as there was three (58%) and eight (52%) years prior. An additional 26% to 29% reported that they think that there are more fish today than in these previous years. The general belief of no change to slightly increasing fish abundance was essentially similar over the three-year and eight-year time frames reported on in this study.

Perceived changes in abundance of fish is shown in Figure 30 for north and south Mackenzie river and lake fisheries. North Mackenzie river-fishing households and south Mackenzie lake-fishing household report that the abundance of fish has not changed perceptibly since 1980. Households fishing in south Mackenzie rivers and north Mackenzie lakes are perhaps more positive about the abundance of fish. Figure 30 suggests that in these fisheries, there may be a slight trend towards the perception that there are more fish than there were in 1980.

Perceived Abundance of Fish in 1988, Compared to 1985



Perceived Abundance of Fish in 1988, Compared to 1980

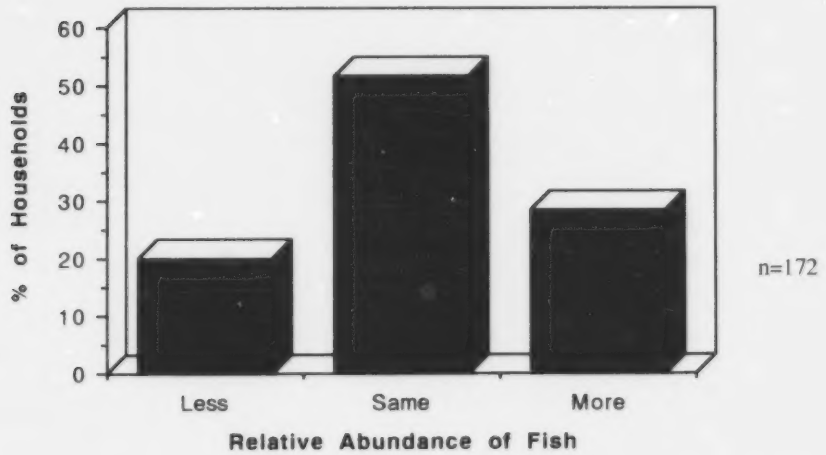


Figure 29: Perceived change in abundance of fish.

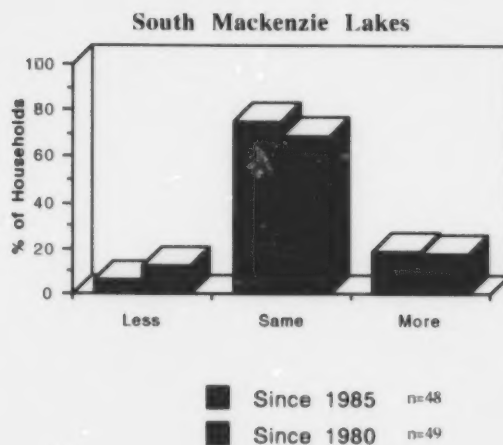
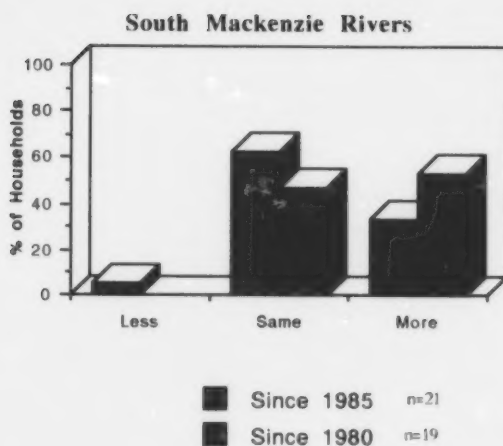
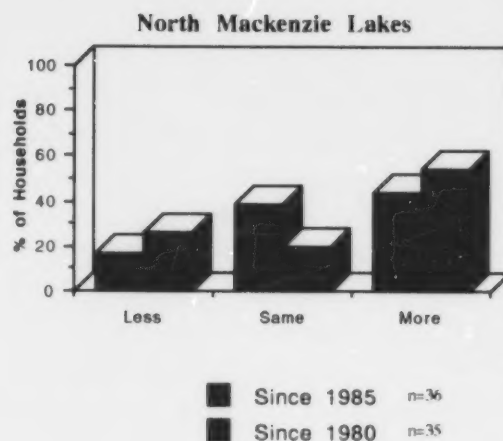
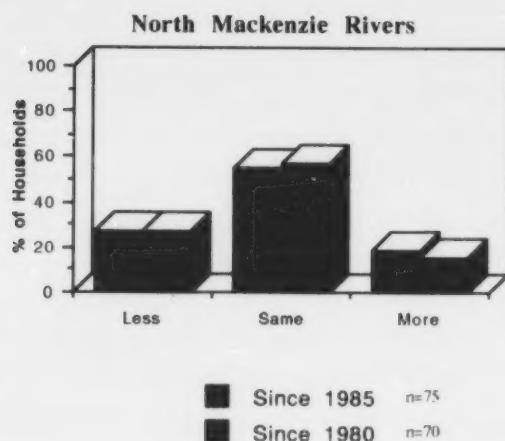


Figure 30: Perceived change in abundance of fish in north and south Mackenzie river and lake fisheries.

3.3.8 Adequacy of Stored Fish Supplies

By the end of each fishing season (spring, summer, fall and winter) the majority of households felt that they had enough fish stored, either smoked, dried or frozen, to meet their needs (Figure 31). This degree of confidence in, or satisfaction with the adequacy of the stored seasonal harvest was greatest for the winter fishery. However, it should be noted that Figure 31 also suggests that concern exists in some households (up to 29%) about the adequacy of the stored supply of fish.

However, this concern about whether there was enough fish stored to meet domestic needs was not evident in all communities. Figures 32 through 35 suggest that most south Mackenzie river-fishing households and north and south Mackenzie lake-fishing households felt that they had an adequate supply of stored fish. However, about one half of the households fishing in the north Mackenzie region rivers felt that they had inadequate supplies of fish at the end of the spring, summer and fall fishing seasons. By the end of the winter, about one third still felt that the stored supply was insufficient to meet their needs.

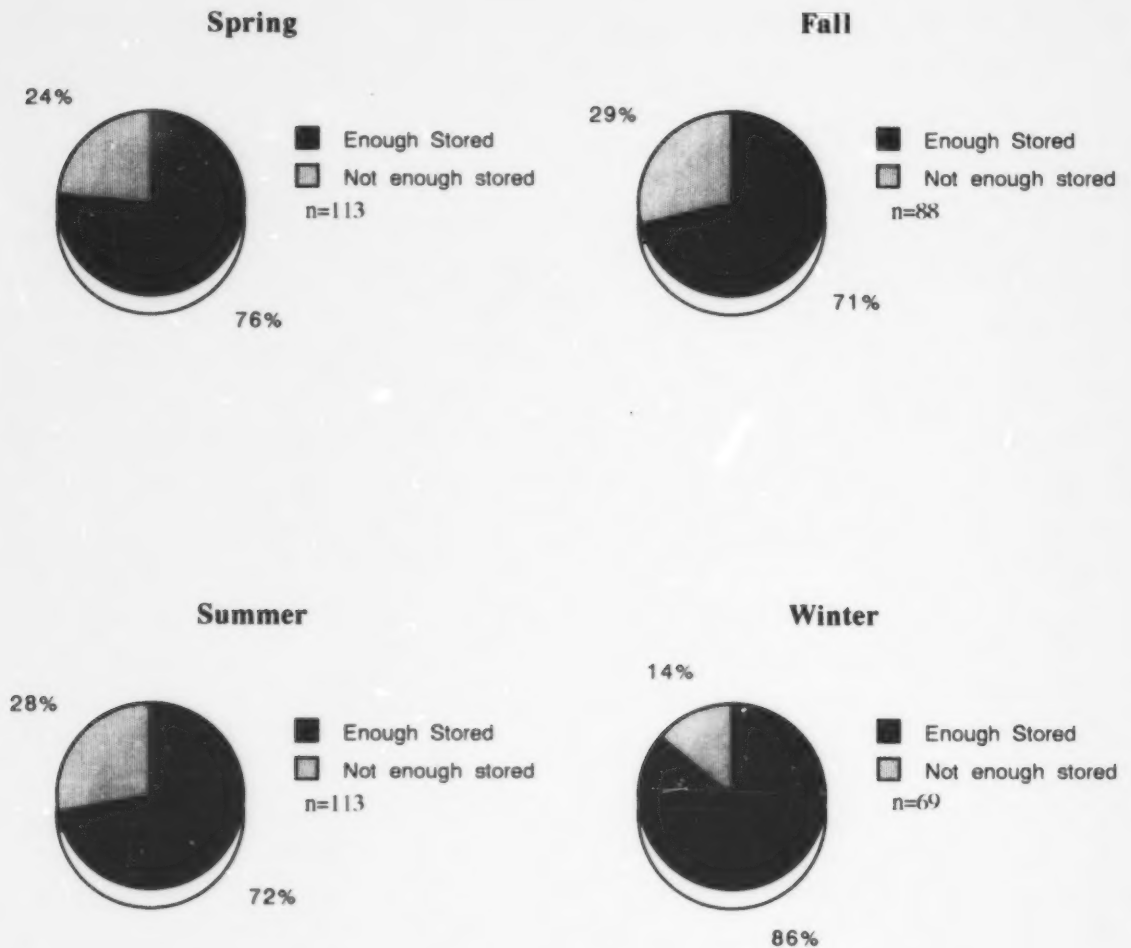


Figure 31: Adequacy of amount of fish stored at end of each season (for Mackenzie River Valley, overall).

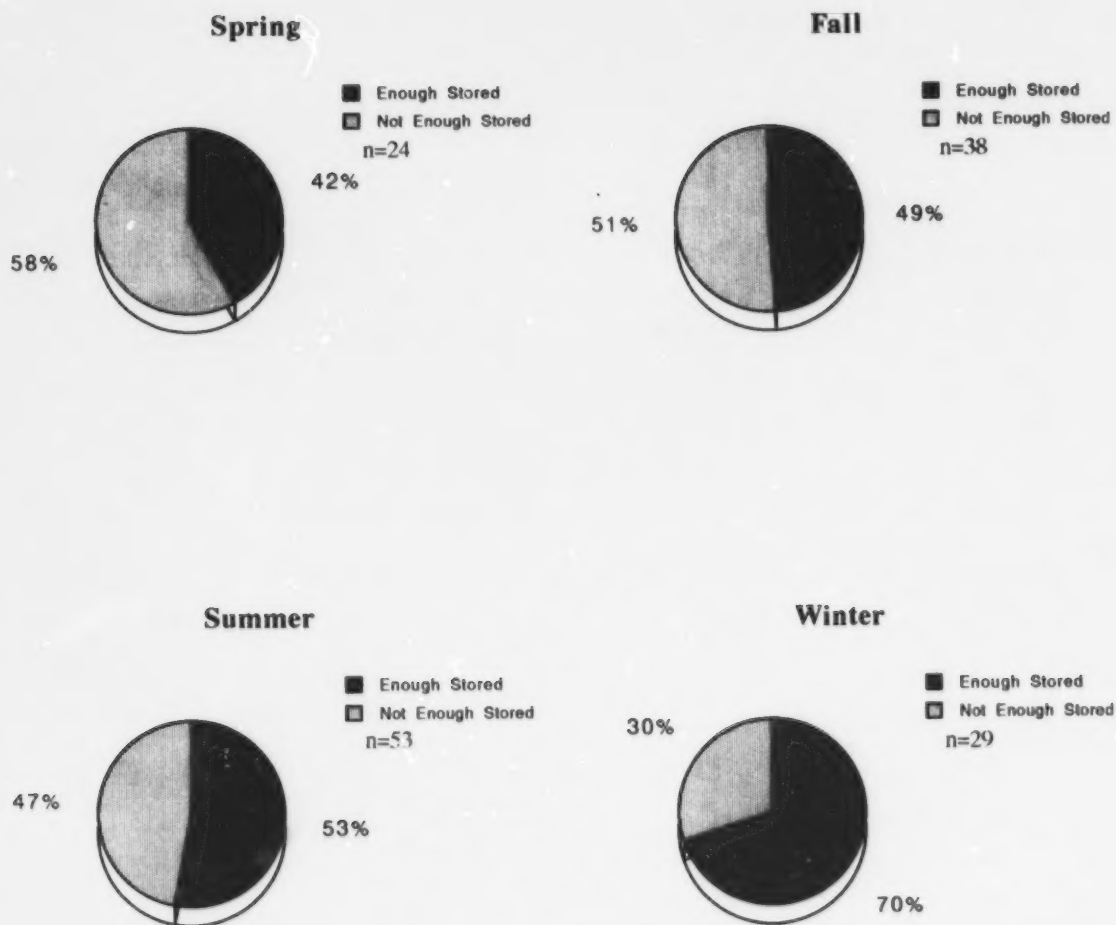


Figure 32: Adequacy of stored fish at the end of each season, for households participating in the river fishery of the north Mackenzie River region.

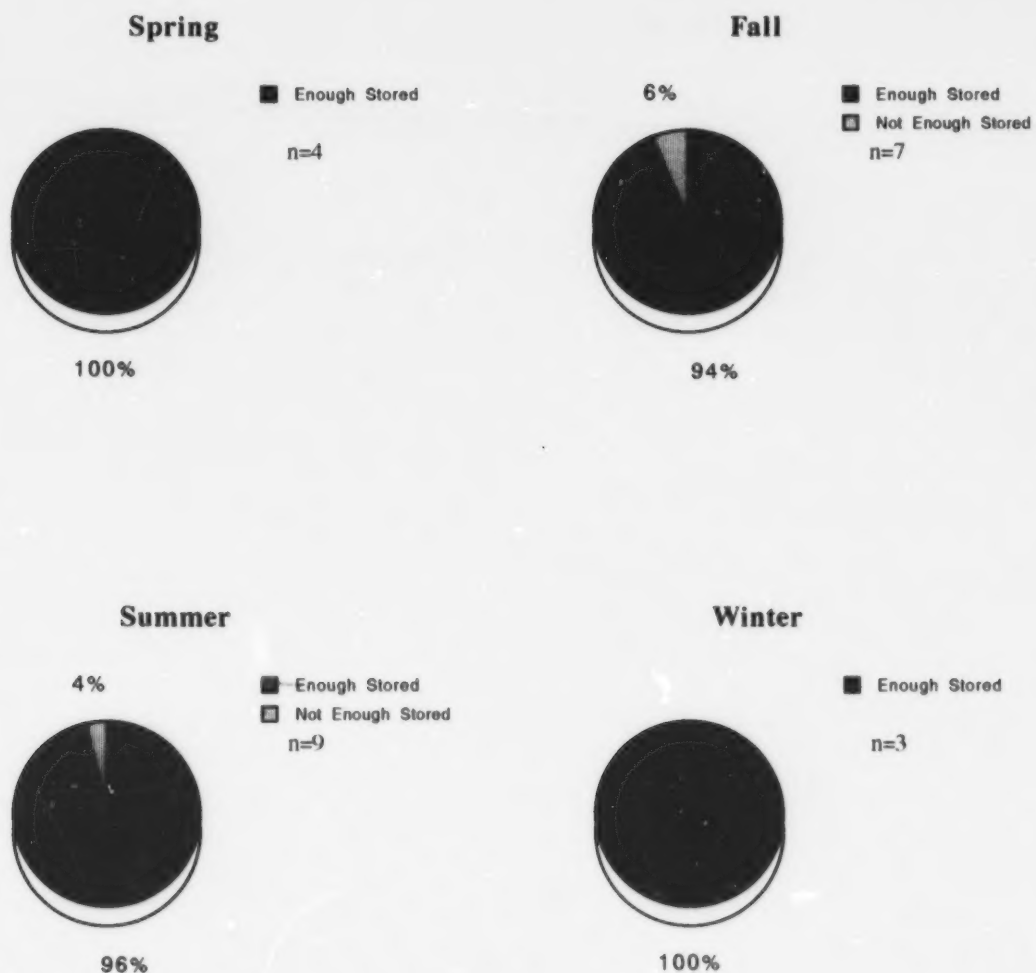


Figure 33: Adequacy of stored fish at the end of each season, for households participating in the river fishery of the south Mackenzie River region.

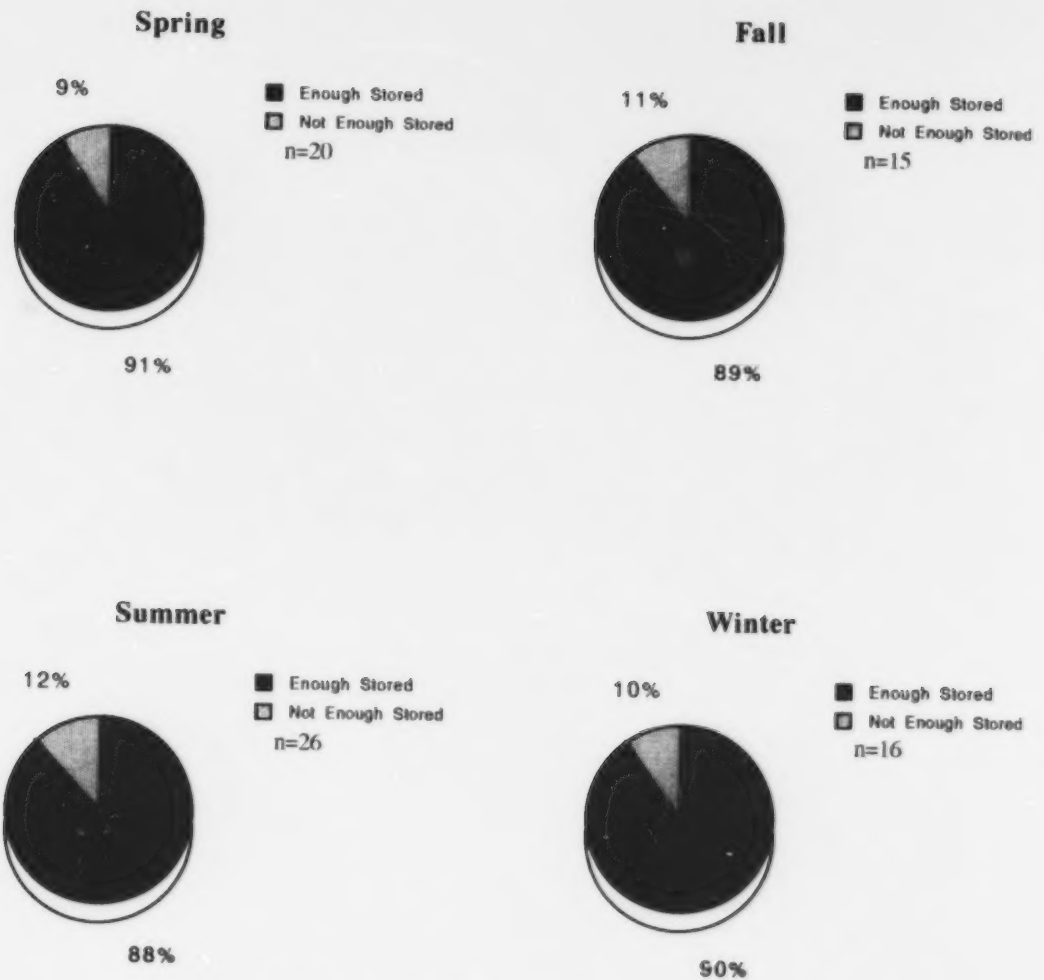


Figure 34: Adequacy of stored fish at the end of each season, for households participating in the lake fishery of the north Mackenzie River region.

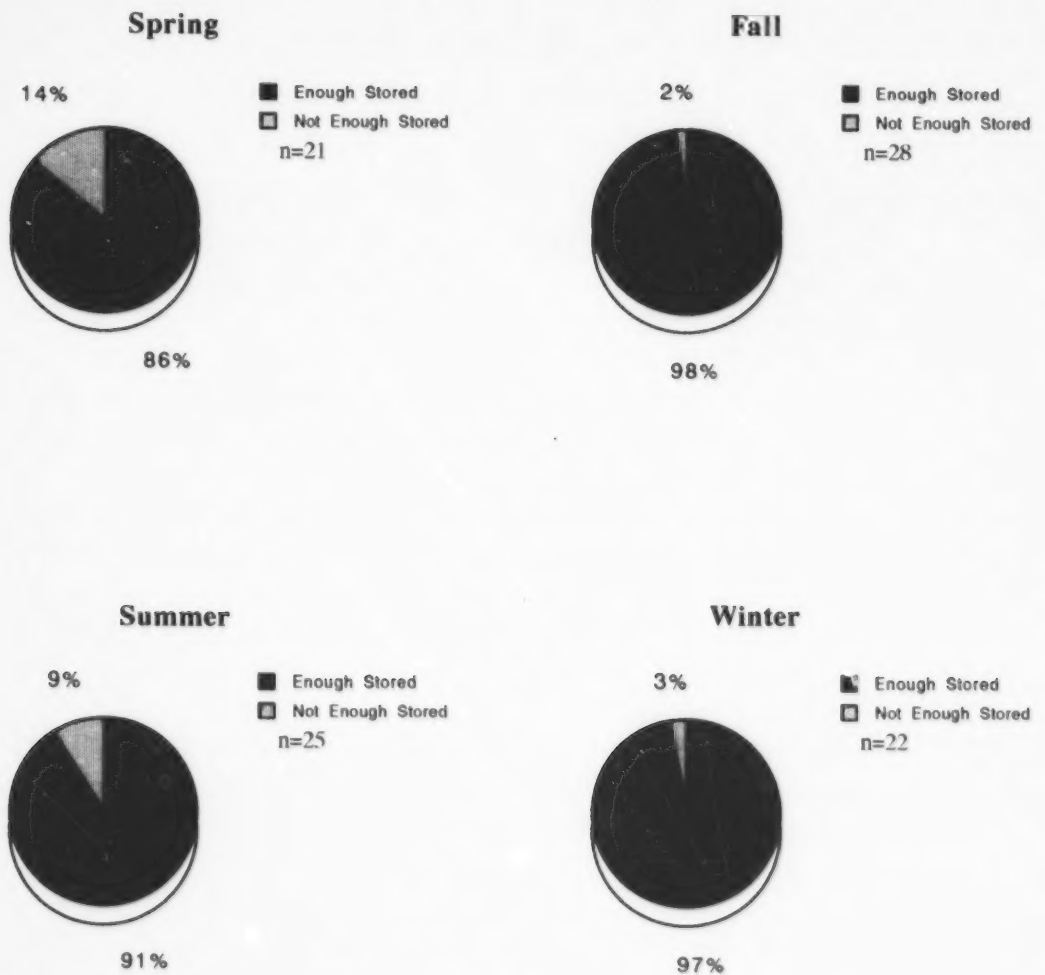


Figure 35: Adequacy of stored fish at the end of each season, for households participating in the lake fishery of the south Mackenzie River region.

3.3.9 Perceived Quality of Fish

Some of the households participating in the domestic fishery during the 1987/88 season reported that they had seen fish that were "abnormal" in appearance. Figure 36 shows that reports of "abnormal" fish were cited by 23%-27% of the households in the spring, summer and fall. Fewer households (13%) reported seeing "abnormal" fish in the winter fishery.

Figures 37 through 40 show the proportion of households that reported having seen "abnormal" fish in the Mackenzie Valley regions. While a relatively low response, particularly from south Mackenzie river-fishing households and north Mackenzie lake-fishing households makes conclusive comparison difficult, there appears to be the following general patterns:

- relatively few households in lake-fishing communities, both in the north Mackenzie and in the south Mackenzie, noticed "abnormal" fish;
- a relatively greater number in river-fishing communities, both in the north Mackenzie and in the south Mackenzie, noticed "abnormal" fish; and thus
- much of the overall reports of "abnormal" fish in the Mackenzie River watershed may be related to the river fisheries.

Despite the reports of apparent "abnormalities" by some, essentially all (96%-100%) of the households fishing in the spring, summer, fall or winter described the overall quality of the fish that they caught as "good" rather than "poor" (Figure 41). This description was similar for all species.

The fish were generally described as being of "good" quality, and in the spring, fall and winter nearly all of the households reported that all of their fish were "normal" in appearance and taste as is shown in Figure 42. The characterisation of the fish almost exclusively as being of "good" quality and of "normal" appearance and taste suggests that while about one quarter of the households recalled having seen "abnormal" fish, they likely did not perceive "abnormalities" to be of extensive or general occurrence in the resource during these three seasons.

However, several households reported some problems with the appearance and taste of fish, particularly in fish from the summer fishery. "Abnormal" appearance and taste of fish from the summer fishery was reported by twenty percent of households fishing in the

summer. These complaints about fish quality were largely from households fishing in the rivers of the north Mackenzie River area. About three quarters of the complaints about the appearance and taste of fish from the summer fishery were from north Mackenzie river-fishing households. This rate of complaint was approximately twice what might be expected based on the proportion of north Mackenzie river-fishing households in this study.

The incidence of complaint about each species, relative to the number of households catching that species is shown in Figure 43. As can be seen, the quality of broad whitefish and burbot generated the highest degree of dissatisfaction of all species in all seasons except the winter. This degree of dissatisfaction with the condition of broad whitefish and burbot was similar (30%-38%) in all seasons except the winter. In the winter, the incidence of complaints about the condition of all species was lower than in the other seasons. Most notably, the degree of dissatisfaction in the winter with broad whitefish and burbot was close to one-half that of the other seasons. However, complaints about the fish in the winter did occur, and burbot was the species with which the households were most dissatisfied.

The predominance of complaints about the condition of broad whitefish (spring, summer, fall) and burbot (all seasons) suggests that much of the perception of "abnormalities" is likely related to the broad whitefish and burbot components of the fishery.

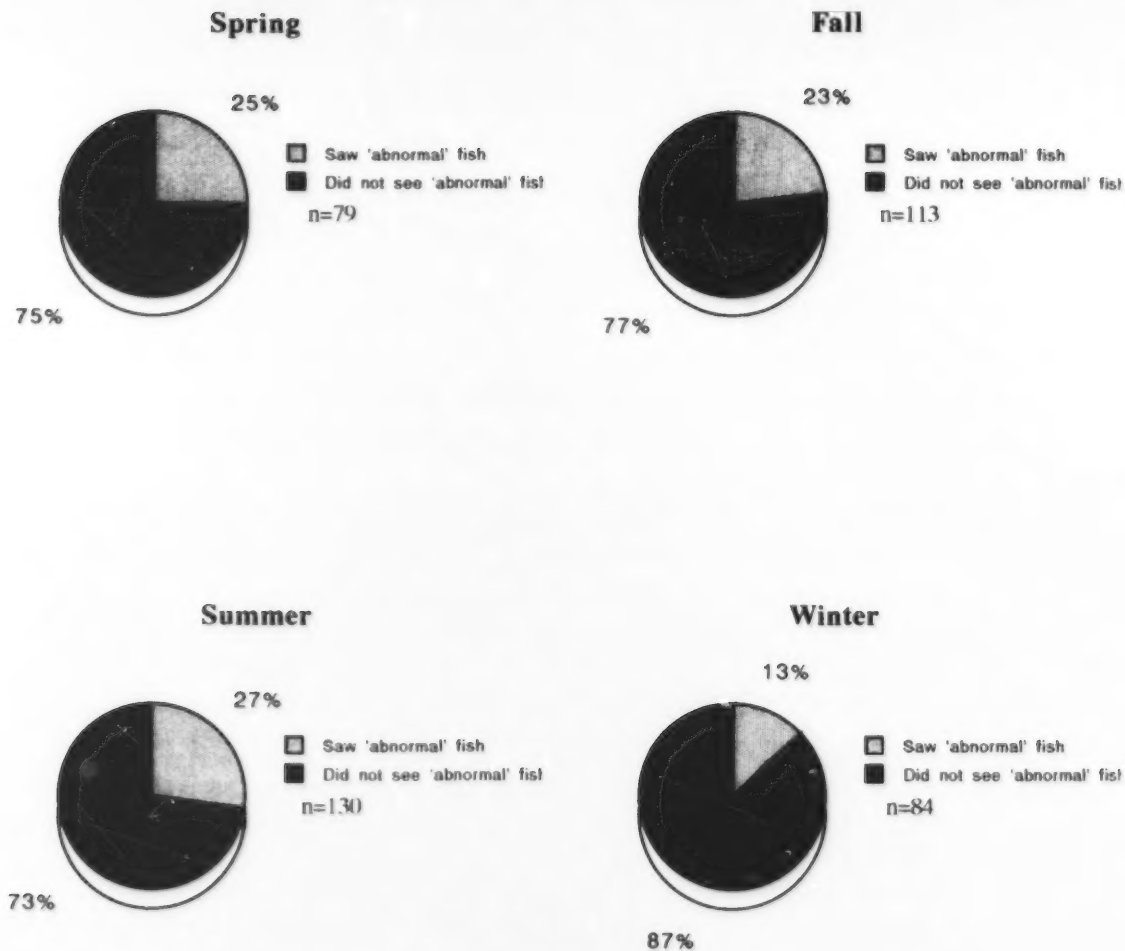


Figure 36: Proportion of households that noticed “abnormal” fish during each season (for the Mackenzie River Valley fishery overall).

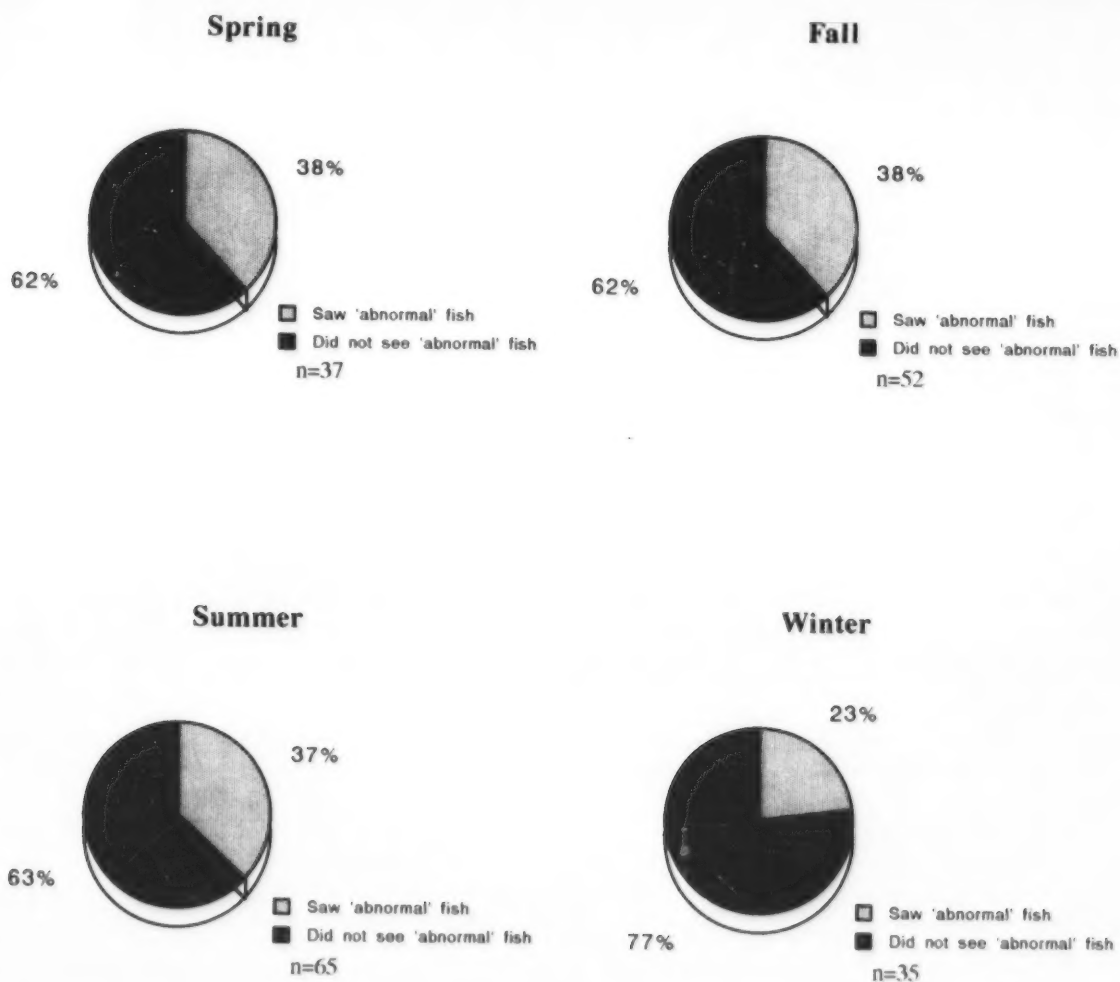


Figure 37: Proportion of households, participating in the river fishery of the north Mackenzie River region, that noticed “abnormal” fish.

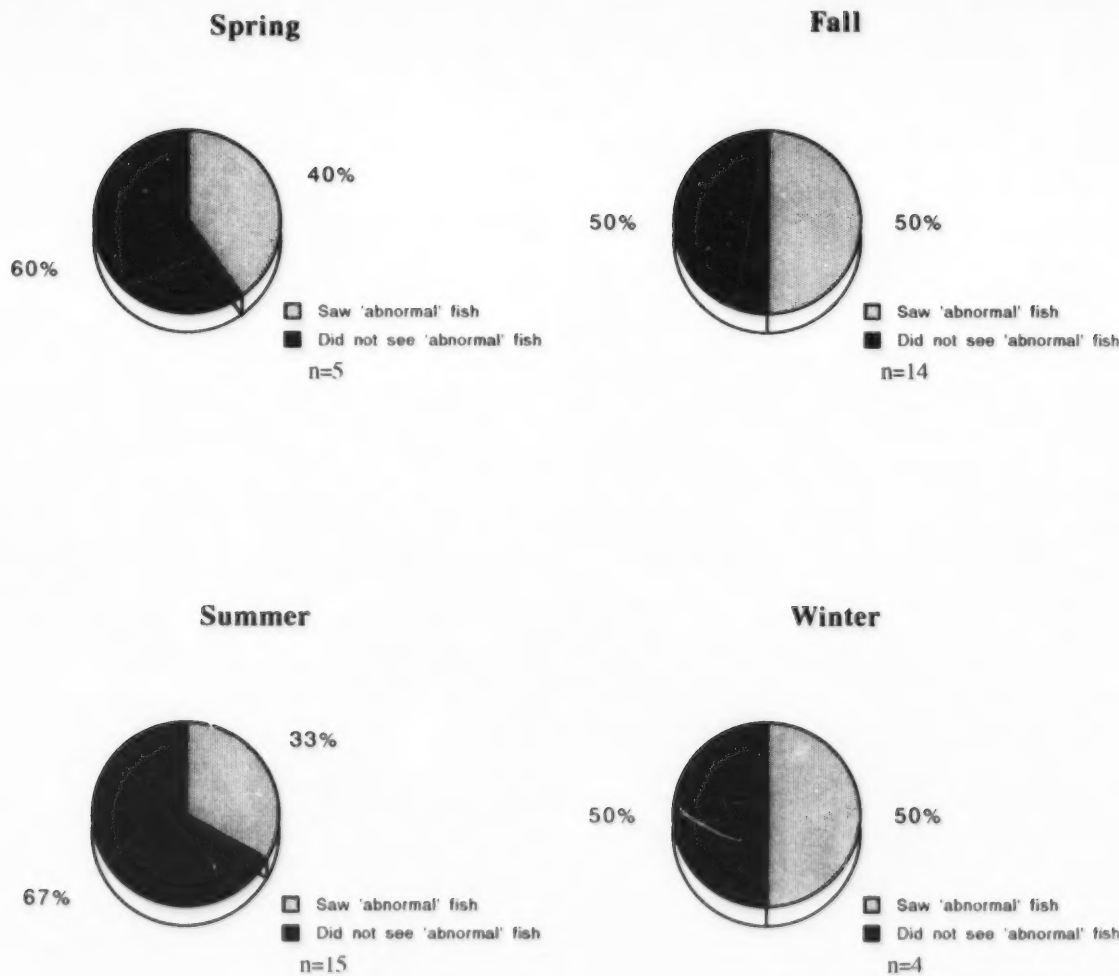


Figure 38: Proportion of households, participating in the river fishery of the south Mackenzie River region, that noticed "abnormal" fish.

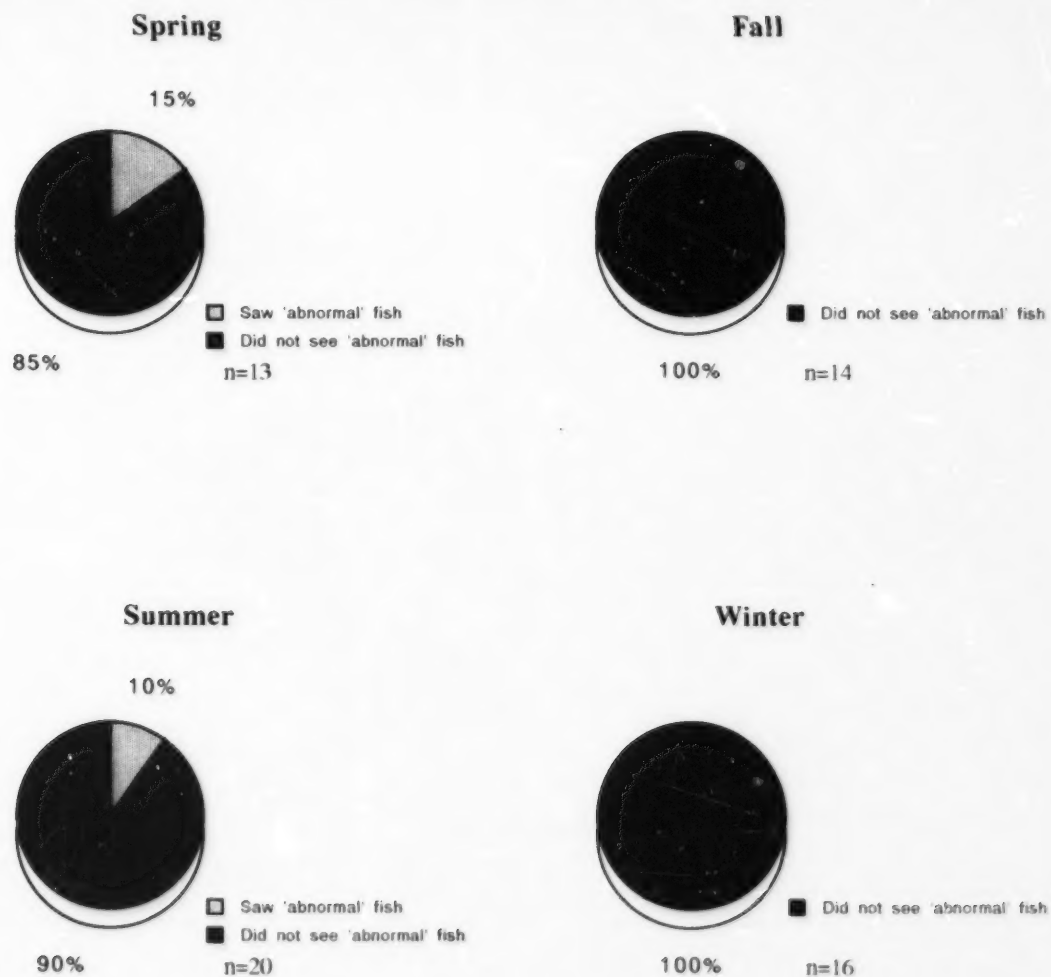


Figure 39: Proportion of households, participating in the lake fishery of the north Mackenzie River region, that noticed "abnormal" fish.

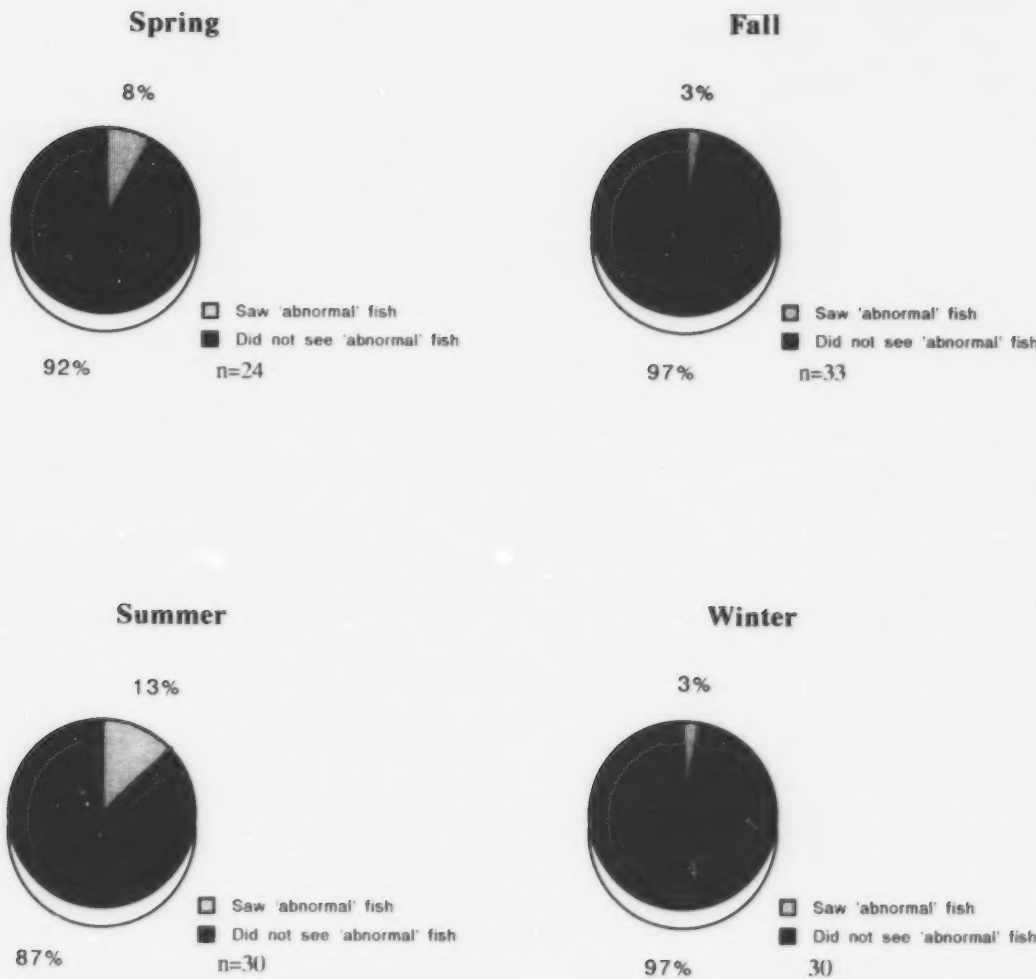


Figure 40: Proportion of households, participating in the lake fishery of the south Mackenzie River region, that noticed “abnormal” fish.

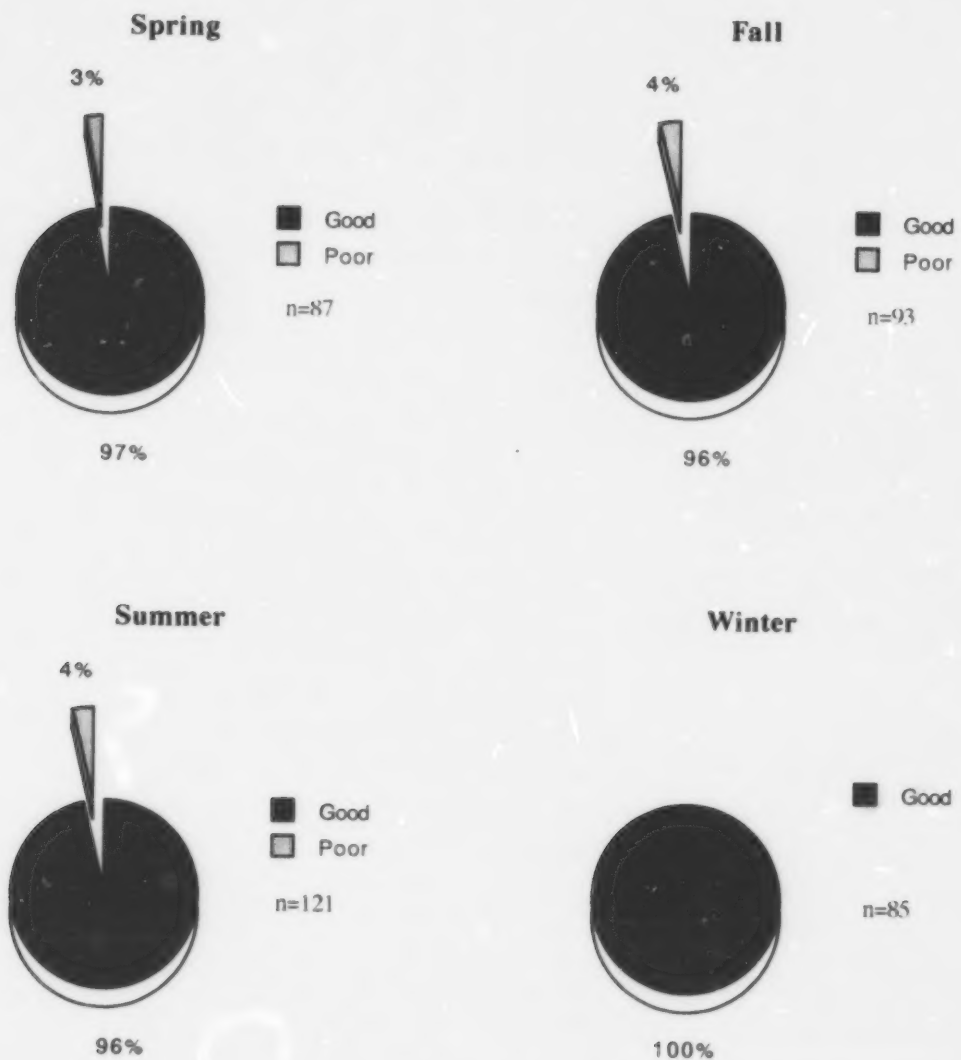


Figure 41: Perception of overall quality of the fish caught in each season (for the Mackenzie River Valley fishery overall).

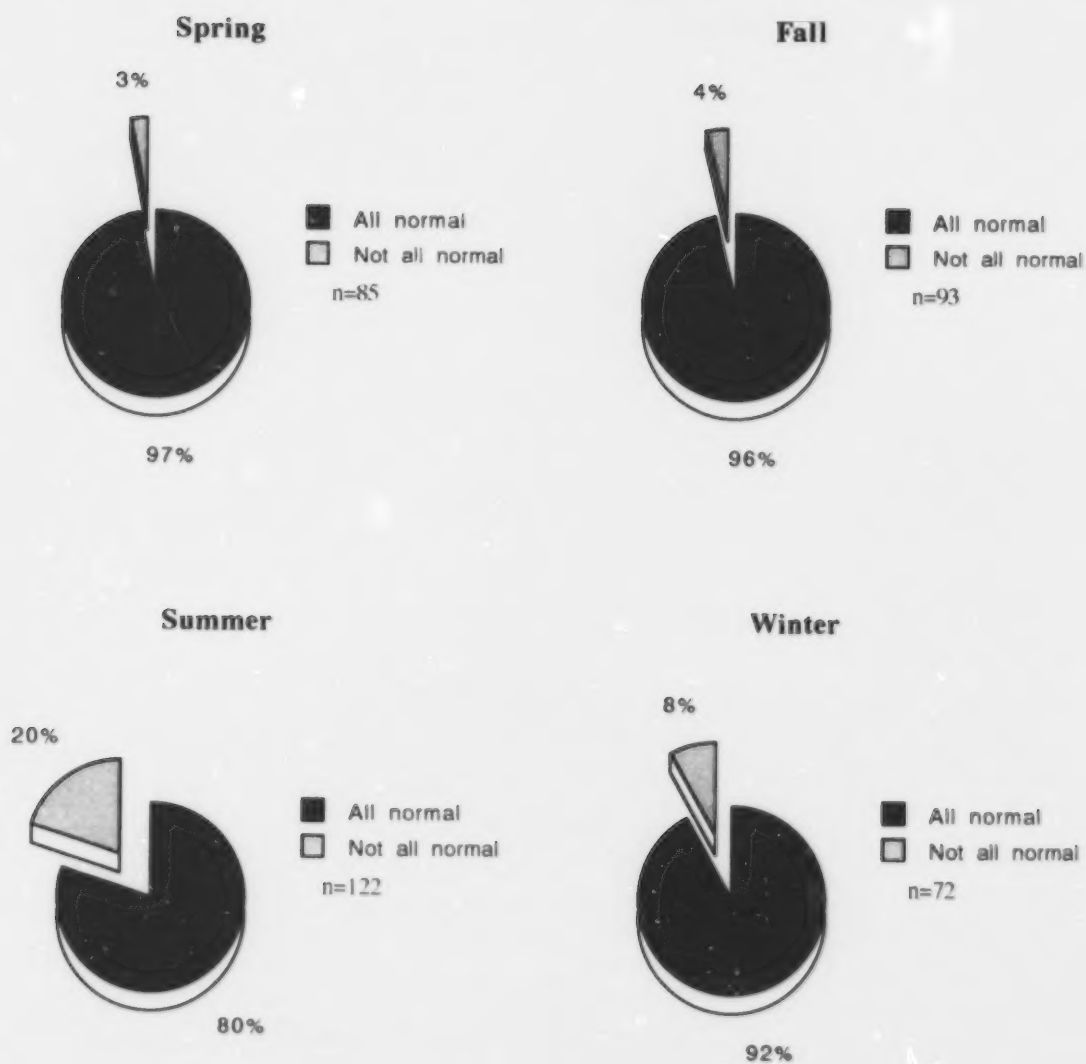


Figure 42: Appearance and taste of fish caught in each season (for the Mackenzie River Valley fishery overall).

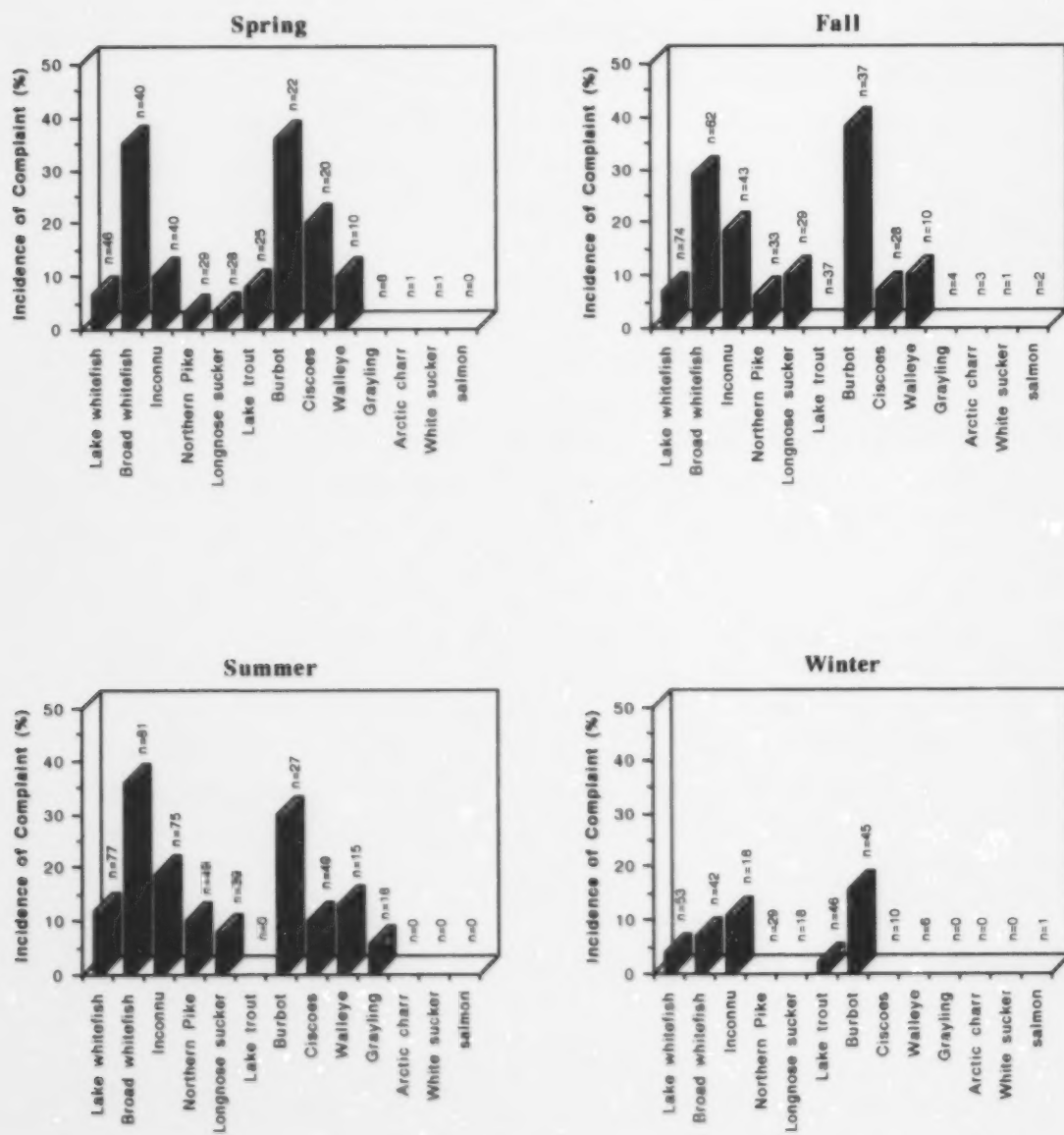


Figure 43: Relative incidence of complaint for each species in the spring, summer, fall and winter fisheries. Note: incidence calculated relative to number of households catching the species.

3.3.10 Perceived Abnormalities: Specific Reports

Few specific external or internal perceived "abnormalities" were reported, except for broad whitefish, inconnu and burbot. Figure 44 shows the proportion of the households fishing for each species that reported finding what they considered to be abnormal or unusual qualities in the skin, fins, head, flesh, liver and guts, during the fishing year. Data for perceived "abnormalities" of eggs or milt were not analysed due to inconsistent coding of data prior to analysis.

As is shown in Figure 44, perceived "abnormalities" in broad whitefish were both external and internal, consisting mainly of reports of problems with the skin and flesh. Reports of skin "abnormalities" largely consisted of reports of "scars, bites or cuts". The flesh "abnormalities" cited consisted largely of reports of "white spots" and "soft and watery flesh". Together, perceived skin and flesh "abnormalities" were reported by over one third of all households catching broad whitefish.

Reports of perceived "abnormalities" in inconnu were largely external, consisting largely of reports of "scars, bites, or cuts" in the skin. These problems were noted by about 15% of all households catching inconnu.

In contrast, perceived "abnormalities" in burbot were almost exclusively internal. Concern with burbot liver accounted for essentially all of the complaints about this species. Approximately one third of all households that caught burbot reported that they believed that there was something wrong with the livers of some of the fish. Nearly all of these households described the livers as being shrunken and discoloured ("small and dark"). Most of the complaints about the condition of burbot liver were from north Mackenzie river-fishing households.

Thus, while most of the fish are apparently perceived as being healthy and of "normal" condition, there appears to be concern about the quality of some fish, particularly broad whitefish and burbot, by many of the households engaged in the domestic fishery.

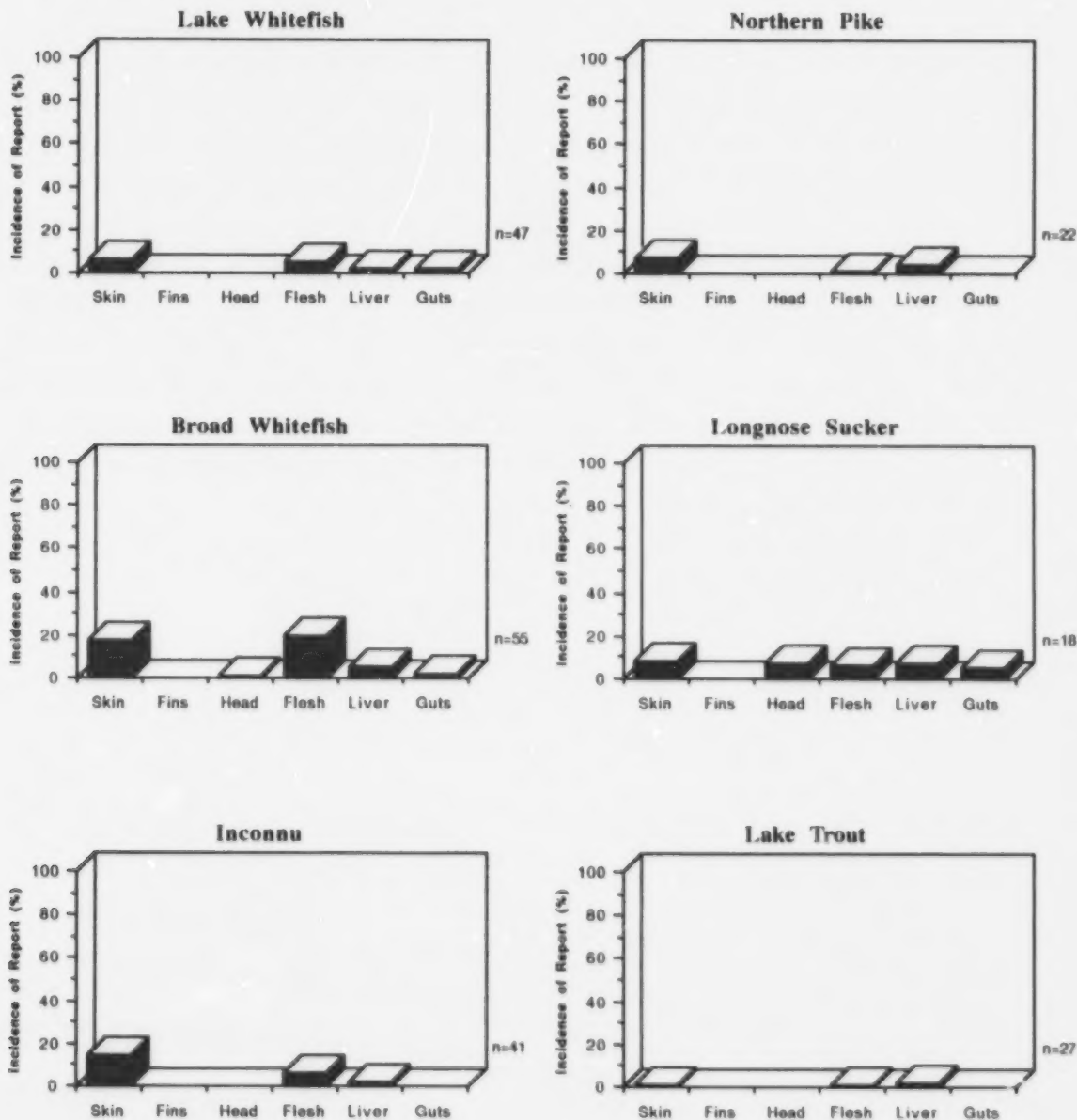


Figure 44: Incidence of reports of specific "abnormalities". Note: Incidence calculated relative to average number of households catching each species (spring, summer, fall and winter fisheries). "n" reported as average of spring, summer, fall and winter fisheries.

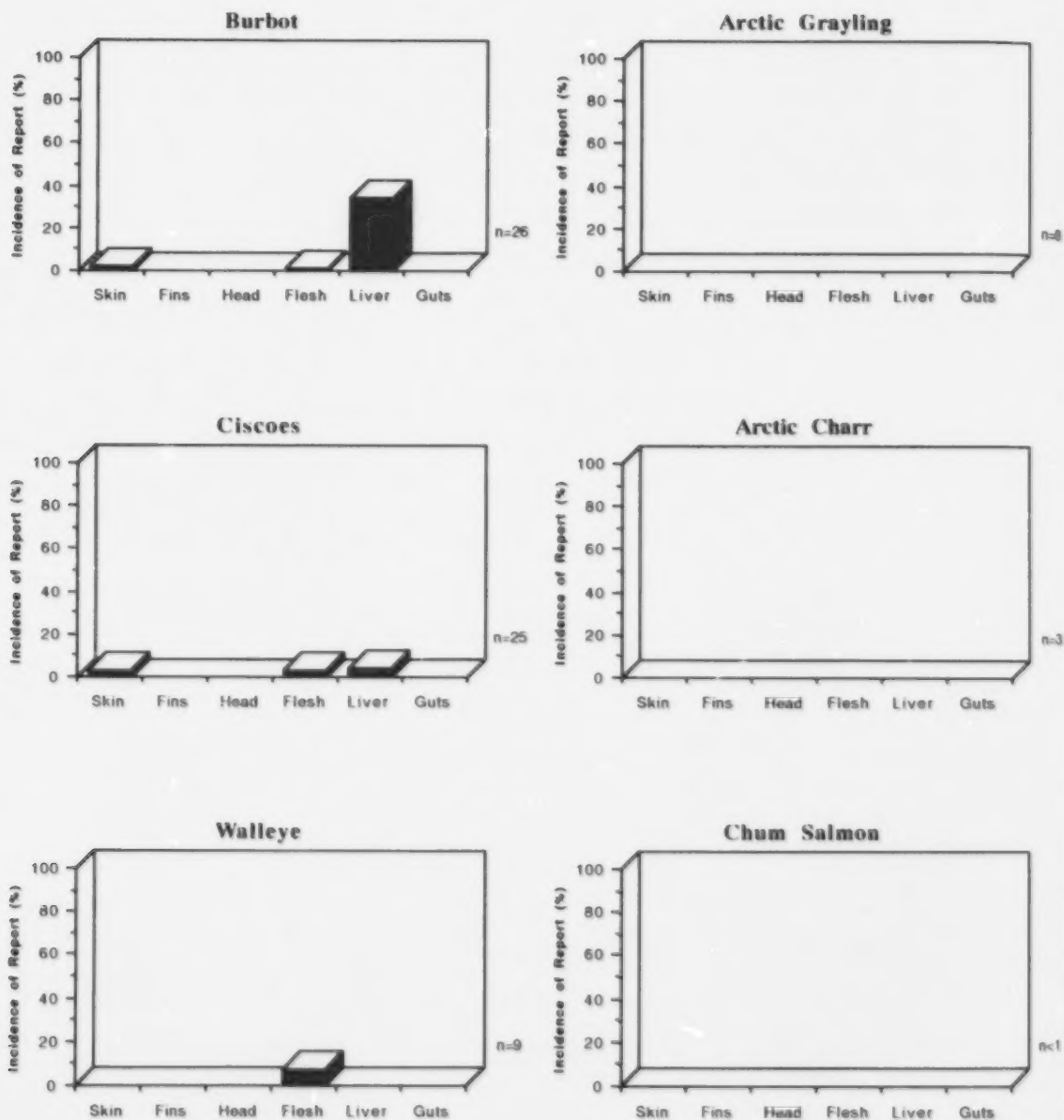


Figure 44 (cont'd): Incidence of reports of specific "abnormalities". Note: Incidence calculated relative to average number of households catching each species (spring, summer, fall and winter fisheries). "n" reported as average of spring, summer, fall and winter fisheries.

3.3.11 Perceived Abnormalities: Proportion of Catch Affected

While the fish were, for the most part, described as being of “good” quality, some households expressed the view that some of the fish that they caught were “abnormal” in either appearance or taste. The proportion of their catch that was perceived to be “abnormal” is shown by season in Figure 45. As can be seen in this figure, most of the households reported that less than one quarter of their catch was “abnormal”. It should be noted that due to a design flaw in the questionnaire, data for all households reporting no “abnormalities” whatsoever are likely included in the “ $<1/4$ ” tabulation of “abnormal” catch. While it is possible that most of the households reported “abnormalities” in up to 25% of their catch, it is also as likely that most of the households reported no abnormalities at all. However, it can be said that at least during the summer, several households felt that a substantial proportion of the fish that they caught were “abnormal” in appearance or taste.

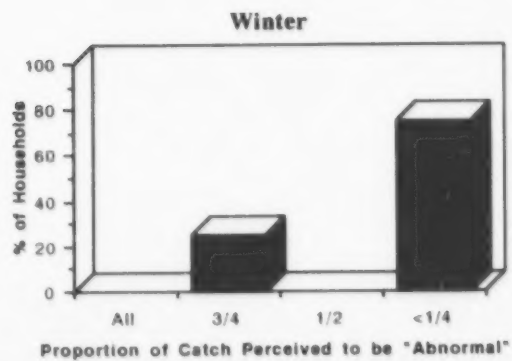
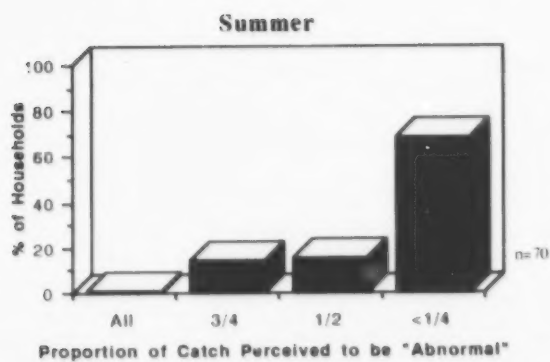
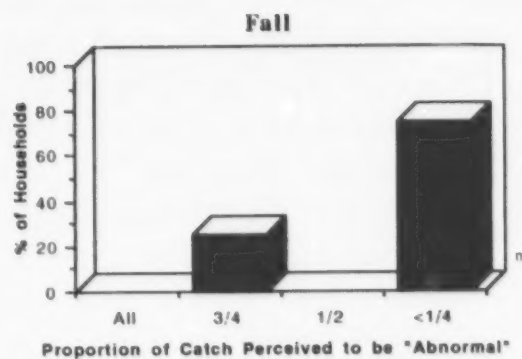
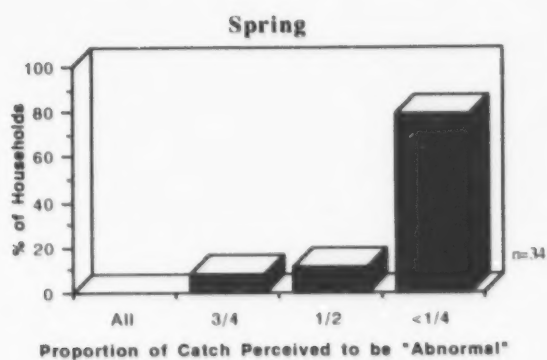


Figure 45: Proportion of catch perceived to have "abnormalities".

3.3.12 Perceived Abnormalities: Changes in Abundance

There was apparently little consensus among the households about how the relative numbers of "abnormal" fish have changed since they were first noticed. The response to this question was relatively poor for most seasons, making interpretation difficult. Figure 46 shows how the households felt about the relative abundance of these fish in each season. It is apparent that in all seasons, there is the perception of change in the state of the resource as relatively few households indicated that there is just about the same number of these fish. Figure 46 suggests that in the spring and fall, opinion is divided, with many households suggesting that there are more "abnormal" fish now and many suggesting that there are less now than before. However, in the summer and winter it would appear that it is perceived that there are more "abnormal" fish today than when they were first noticed.

Similarly, there was little consensus among the households as to when "abnormal" fish were first noticed. Response was generally poor to this question and despite the use of date or local community milestones, the households had substantial difficulty in attaching a date or time period defining when these "abnormal" fish first appeared in the fishery. Responses have been grouped into general time categories and are presented in Figure 47. No clear pattern is evident in Figure 47, and it is suggested that there was apparently no date or historical period that the households consistently associated with first noticing "abnormal" fish in the domestic fishery.

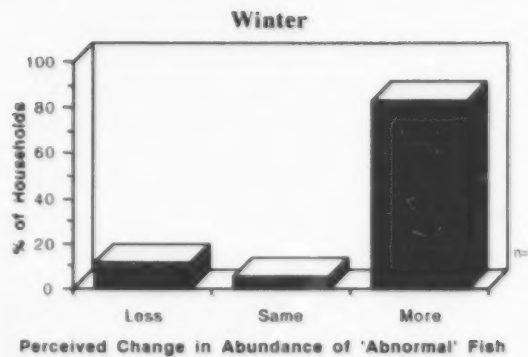
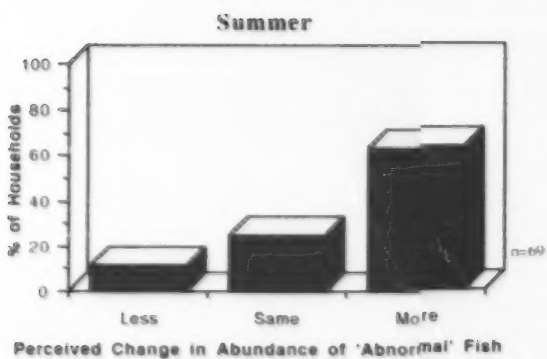
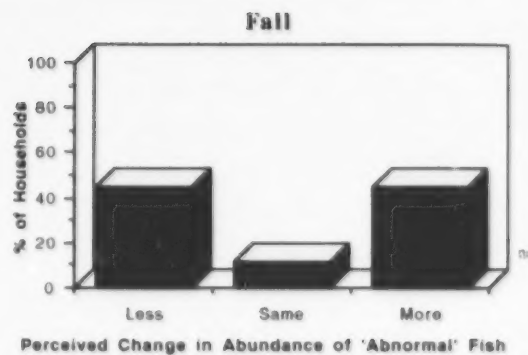
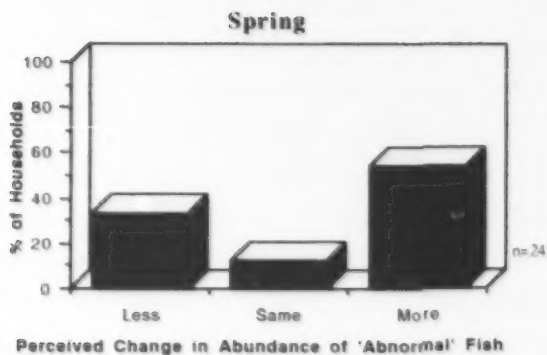


Figure 46: Perceived change in abundance of "abnormal" fish, since they were first noticed.

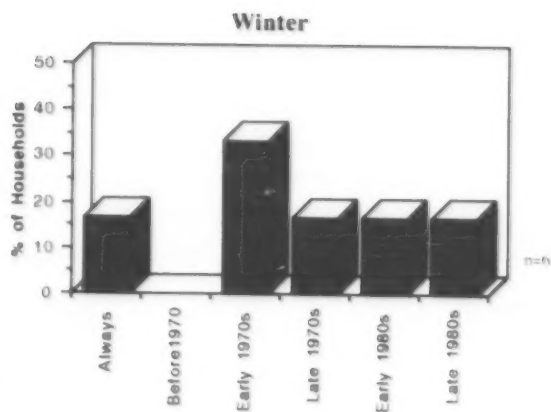
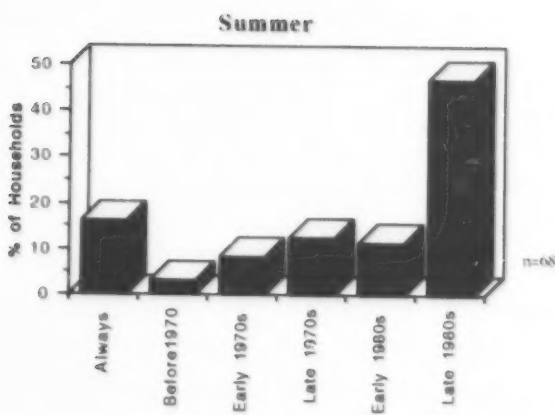
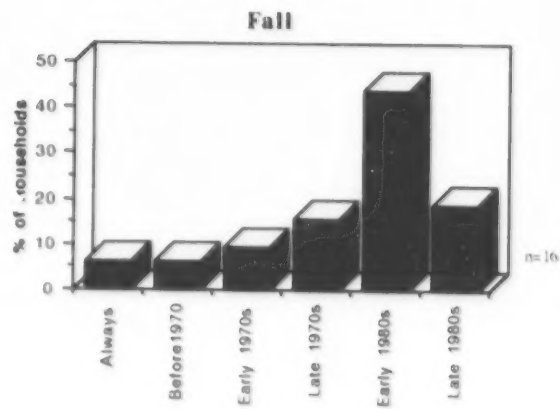
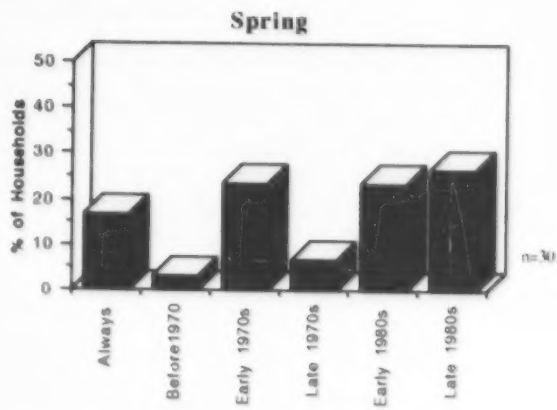


Figure 47: Historical period when "abnormalities" in fish were first noticed.

4. DISCUSSION AND CONCLUSIONS

There was generally a high degree of interest in and support for this study among the domestic-fishing households. However, the varying and, at times, very low rates of response to many of the questions raises concern about the "robustness" of the data. This is not altogether surprising, considering:

- the length, complexity and repetitiveness of the questionnaire;
- the fact that respondents were asked to recall information related to the domestic fishery for periods over the previous eight years
- that there were some problems with the questionnaire forms (such as misdirection in instruction eg. Q35)

As a result of these considerations, the results of the questionnaire have been interpreted as much as possible to suggest general trends and patterns in the domestic fishery, rather than definitive, quantitative changes.

It must be understood at the outset that this study does not present biological data about the abundance or quality of fish or fish stocks. Rather, this study sought to "tap" the traditional knowledge of the participants in the domestic fishery and thus presents information describing how the domestic-fishing households perceive the state of the fishery. This information acts as a "barometer" of the state and health of the fishery, complementing biological and ecological information.

Recently, there have been reports of depletion of local populations of fish (cited in Crawford, 1989) as a result of long-term domestic fishing. Numerous authors (eg. LGL Ltd., unpublished; Crawford 1989; Yaremchuk & Wong, 1989; Corkum & McCart 1981) have identified information deficiencies about the fisheries of the NWT. Until these issues are addressed and adequate monitoring established, few conclusions about the state and sustainability of the domestic fishery can be made.

This study provides an overview of the importance of the domestic fishery in and near the Mackenzie River watershed. The role of country foods, including fish, in the diet of these households is substantial. The estimates derived in this study show that, on average, two thirds of the household diet consisted of country food, of which one third was fish. Similarly, the time devoted to the fishery occupies a good deal of the daily and yearly activities of the Dene and Métis people in the Mackenzie Valley. Clearly, the domestic fishery plays a prominent role in the lives of the domestic fishing households. It is likely, through the domestic exchange of fish and other local social, economic and cultural activities, that the domestic fishery also plays an important role at the community level as well. The findings of this study serve to reinforce the importance of traditional foods and activities to the well-being of the people participating in this study and to the economy of the Northwest Territories.

The level of fish consumption by the domestic-fishing households appears to have been stable, at least over the period covered by this study. This suggests that there has not been a substantial change in the dietary habits of these people in recent years. This study included only households participating in the domestic fishery and the results may not necessarily represent all of the Dene and Métis households in the communities. It would be of interest to determine the role, importance and trends in fish consumption for all households in these Mackenzie Valley communities. To this end, the Health and Welfare Canada dietary study being undertaken for residents of Colville Lake and Fort Good Hope may be instructive.

Some changes in the state of the domestic fishery are indicated by this study. While most of the households still fish as much as they used to, many households appear to be fishing less. The trends toward keeping fewer dogs, and some households having less time for domestic-fishery activities suggests that there may be a shift in the lifestyle of the Dene and Métis people away from some traditional domestic activities. What this may mean in terms of dependence on the fishery and other resources is not clear. However, it should be noted that a joint GNWT/aboriginal peoples working group is examining proposals for a territory-wide Wildlife Harvesting Income Support Program (WHISP). A WHISP in the NWT will have significant ramifications for the domestic fishery. It will enable more aboriginal people to afford to hunt, fish and trap. It will likely increase the participation in the domestic fishery, the domestic component of the NWT fishery, and the overall harvest of fish. This will not only reinforce the role of the domestic fishery, but

points to the importance of ensuring the safety of the traditional food supply and sustaining the domestic fishery.

Throughout most of the Mackenzie Valley communities in this study, there was a perception that there are about as many fish as there have been in the recent past, suggesting that there have not been substantial changes in abundance. Similarly, there is general satisfaction among most households with the ability of the domestic fishery to supply their fish needs. However, this is not the case for many of the north Mackenzie river-fishing households, that expressed concern about the amount of fish they were able to store each season. This concern expressed by the households in these communities is unexplained by this study and may warrant investigation.

The households that participated in this study are generally satisfied that their fish are of good quality and "normal" in appearance and taste. The results of this study suggest that perceived "abnormalities" may not be a problem in most species and most fisheries with the exception of burbot and broad whitefish caught in the north Mackenzie river-fishery. Clearly, any concern about fish quality that results in rejection of the fish for human consumption, such as the "small dark liver" condition of burbot, may have a detrimental effect on the value of the fishery and its ability to meet domestic requirements. This may in part explain the perception of many north Mackenzie river-fishing households that they were unable to store enough fish each season.

Concern about the quality of the fish may also have other effects on the communities that are less easily identified and measured. Given the prominent role and the social and cultural values attached to the domestic fishery, concern about the quality and safety of the fish may introduce an element of insecurity into the society.

While identifying the cause of "abnormalities" in fish is beyond the scope of this study, a review of current knowledge is of interest. A causal relationship between "small dark" livers and hydrocarbon inputs to the Mackenzie River was tentatively suggested by Morgan et al. (1987) in a study of hydrocarbon uptake and effects on Mackenzie River fish. In their study, Morgan et al. had native residents of Fort Good Hope use a two point (good or bad) visual acceptability test for burbot liver from different locations in the Mackenzie River. The results of this judgement survey of the acceptability of burbot liver was not conclusive due to small sample size but suggested a general trend in agreement with known oil seep and refinery effluent locations and with bile analysis for metabolites of polynuclear aromatic hydrocarbons (PAHs).

However, on the basis of bile analysis Morgan et al (1987) suggested that elevated metabolites, a relatively sensitive indicator of hydrocarbon exposure, occurred in relatively localized areas of the Mackenzie River in the vicinity of the Norman Wells oilfield. Similarly, Lockhart et al. (1987) found that burbot from the lower Mackenzie river, downstream of the Norman Wells oilfield, did not have higher levels of contamination, or elevated Mixed-Function Oxidase (MFO) liver activity indicating exposure to contamination, than fish from other watersheds where there is no obvious source of hydrocarbon contamination. Indeed, the "small dark" liver condition has been reported from fisheries that are located off the mainstream of the Mackenzie River (Lockhart 1987, 1989; this study) suggesting that Norman Wells oil is likely not the exclusive or direct cause of this liver condition. However, hydrocarbon and other contamination cannot be conclusively ruled out (Lockhart 1989).

Other factors have been suggested as contributing to the "abnormal" liver condition of burbot. The "small dark" liver condition is associated with low fat content (Lockhart et al. 1987, 1989) and has been induced experimentally by starvation. Parasites have been associated with apparently the same liver condition (cited in Lockhart et al. 1989) and a relationship between liver weight and reproductive status suggested (Lockhart 1989). Thus some aspects of nutrition, parasitism and life history cycles may be operative.

Problems with other fish, such as those described in this study for broad whitefish, have been reported in other studies. Lockhart (1989) found that the average moisture content of lake whitefish and broad whitefish muscle from the lower Mackenzie Valley was generally higher than in whitefish from other North American locations and concluded that the complaints of "watery" flesh, such as reported in this study for broad whitefish, appeared to be justified. However, given the findings of Lockhart (1989), the low incidence of complaint in the present study about flesh quality of lake whitefish is intriguing, and unexplained. Lockhart (1989) speculated that there are several possible causes for this condition including:

- variation in habitat;
- post-harvest handling;
- fish age;
- season (ie. pre or post-spawning fish);
- diet; and
- pollution induced edema.

However Lockhart's study did not identify the cause of "watery" flesh in whitefish nor whether this condition is of recent occurrence. These questions remain unanswered by this study.

Reports of external "abnormalities" (this study) in broad whitefish are similar to the condition of broad whitefish reported by Reist et al. (1987). In their study, Reist et al. (1987) found that overall, eighteen percent of broad whitefish had external scars or lesions and that the incidence of this condition was greater (up to 40% of broad whitefish) in mainstream Mackenzie River locations than in tributaries. Reist et al. (1987) identified several probable causes of this condition:

- predators such as birds, other fish and bears (52%);
- ectoparasites such as the marine copepod Coregonicola sp. and the Arctic lamprey Lampetra japonica (24%-32%); and
- previous contact with gill nets (16%).

The conclusions reached by Reist et al. (1987) may be of particular relevance to the households of the Mackenzie River watershed that are concerned about this "abnormality" in the whitefish fishery. Specifically, Reist et al. (1987) concluded that:

- external "scarring" seems to cause only "cosmetic" damage to the fish tissues;
- scarred fish should be safe for human consumption;
- much of this condition is likely of natural origin; and thus
- little can be done to reduce the incidence of this condition.

If the external "abnormalities" reported by the households in this study are the same as studied by Reist et al. (1987), it may be that the real problem is one of perception. In particular the issue may be one of decreased perceived value of these fish. Confirmation of the nature and causes of this perceived "abnormality" is required. If indeed this condition is normal and should not cause great concern, this information should be provided to the communities expressing concern about "abnormalities".

The results of this study suggest that, overall, the state of the fishery is healthy. Fish abundance is generally perceived to be the same or better than in recent years. In most communities, the fishery provides adequate supplies of fish. The quality of the fish, for the most part, is described as being "good" and of normal appearance and taste. "Abnormalities" are not perceived to be extensive in the fishery, with the exception of specific complaints about "abnormal" burbot livers and "abnormal" broad whitefish skin and flesh quality. Perceived "abnormalities" in fish may have had little impact on the domestic fishery.

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